Railway Mechanical Engineer

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Mechanical department progress

One mechanical department summarizes the improvement and progress during the last five years in the following way. In 1923, shop not organized on efficient basis; in 1928, operations generally satisfactory, shop conditions being attractive and sanitary. In 1923, 1,805 men employed; in 1928, 1,370 men employed, in spite of heavier power and increased business. In 1923, overtime totalled 9 per cent of the total payroll; in 1928, 0.6 per cent. In 1923, locomotive failures totalled 16.71 per 100,000 miles; in 1928 only .38. In 1923, 45,000 locomotive-miles were made per flue removal and general repair; in 1928, 100,000 miles. In 1923, five fireboxes were applied per month; in 1928, only one. In 1923, four pairs of car wheels were slid flat per 100,000 miles; in 1928, only 1.5 pairs. In 1923, the cost of locomotive repairs per locomotive mile was 40 cents; in 1928, 26 cents. Freight car repairs now cost 12.75 cents, and passenger car repairs 15.50 cents, per thousand miles. Three million car-miles per hot box are being made in passenger service and only 5.1 hot boxes develop per million miles in freight service. In 1922 fuel consumption in freight service was 17.62 gal. of oil per 1,000 gross ton-miles; in 1927, 12.25 gal. The good performance in a few of these factors, particularly the last, reflects credit not only on the mechanical, but also on other departments, without whose hearty cooperation the results mentioned could not have been secured.

Modern locomotives reduce repairs

In discussing the ability of modern locomotives to reduce ton-mile operating costs in freight service, the effect of their increased thermal efficiency in reducing fuel consumption has been most frequently stressed. If the modern locomotives now available were capable of handling no greater train loads than the locomotives of similar weights on drivers built 10 years ago, undoubtedly the principal reduction in operating cost which these locomotives would effect, would come from the reduced fuel consumption. With the increasing demand for a reduction in road time, however, which is gradually eliminating so-called drag freight as a factor in freight-train operation, the increased horsepower output of modern locomotives means increased train loads. Increased train loads, of course, mean a reduction in all items of train operating cost when figured on a gross ton-mile basis. It is significant that the greatest proportionate reduction in any of the items of freight train operating cost effected by certain well-designed modern locomotives is in the cost of repairs. In one case, where a direct comparison was made, there was shown a slight decrease in the cost of repairs per locomotive mile as compared with locomotives of approximately similar driving wheel loads in the 10-year old class, which resulted in a decrease of more than half on the 1,000 gross ton-mile basis of comparison. This was considerably larger than the decrease in crew wages or fuel. It forcibly calls attention to the fact that while efforts to improve thermal efficiency are receiving major attention in discussions of the improvement of the steam locomotive, developments in the design of mechanical details have been taking place which are already making the modern high-capacity locomotive, with its complete equipment of economy— and capacity-increasing devices, no more expensive to maintain than its less well-designed and less completely-equipped predecessor, and much less expensive to maintain per unit of work done.

Who has the best solution of this problem?

A machinist in the central repair shop of a Class 1 railroad developed an ingenious device, the utilization of which has not only saved the road a substantial sum of money, but has also improved the quality of the product. The master mechanic of the shop suggested to the machinist that he should have the device patented. Because of the lack of sufficient funds, the machinist was unable to carry out this suggestion. He has not received any reward for his efforts other than words of appreciation. Kind words are all right in their place, but do they stimulate railroad employees to greater efforts to find ways and means of doing their work quicker and better?

There are many workmen with inventive trends of mind who would lend their efforts to develop labor-saving devices, provided they could feel assured that they would receive some material reward. Many of the men take the attitude that it is unfair for the company only to profit from their ideas. This is particularly true where they are working on a day-rate basis. Men working on a piecework basis can often increase their earnings by devising ways of reducing their labor, thus finishing a job in less time than ordinarily required. Instances could be cited, however, where such efforts of the workmen to save time have been rewarded with a cut in the piecework rates. Such treatment is far from conducive to stimulating original thought and inventiveness on the part of the workmen.

One road has encouraged its men to develop labor-saving devices by paying them a cash bonus ranging from

five dollars to twenty-five dollars for an accepted device that will save the company money. This may appear to be a small sum, but it means a lot to a wage earner. Furthermore, the men who develop a device that is accepted by the road are carefully watched by their superiors to see if they will make good timber for supervisory positions. This plan has worked out advantageously, both to the men and to the company.

Perhaps other roads have taken other means to induce their workmen to develop labor-saving devices. It is quite possible that some of these plans are more effective than the one just cited in stimulating initiative among the workmen. Some roads may have adopted a policy whereby employees are aided in securing patents on marketable railway devices. The *Railway Mechanical Engineer* will gladly print any good suggestions from its readers on this question.

Cause for congratulation

The feeling prevails that there are too many associations in the railway field, and there is a growing sentiment that these associations must justify their existence by the quality of the service they render or else cease functioning. Any move looking toward the consolidation or strengthening of these associations in any way is a constructive effort in the right direction and one bound to receive the support of railway managements in general.

It is a matter for congratulation to all concerned, therefore, that, subject to formal ratification by the joint membership, the officers and executive committee members of the Railway Car Department Officers' Association and the Southwest Master Car Builders' and Supervisors' Association have voluntarily moved to unite their organizations into a new national body known as the Master Car Builders' and Supervisors' Association. The news of this amalgamation, as well as a detailed program of the joint convention to be held at St. Louis, Mo., September 11-13, appears elsewhere in this issue. From an examination of the program, as well as from all other indications, the coming convention will be one of the best attended and most important meetings of railway car department supervisors held in recent years.

The advantages of consolidation of the Railway Car Department Officers' Association and the Southwest Master Car Builders' and Supervisors' Association, involving as it does the holding of a single joint convention at St. Louis instead of two separate conventions, are almost too numerous to mention. Duplication of effort and attendant expense are avoided, and a larger attendance is assured, permitting the development of a better program and more representative discussion. With a larger attendance of able car department supervisors from all parts of the country, any action taken will carry greater weight, and the influence of the united and strengthened association in promoting car department efficiency and economy will be greatly increased.

There is no question about the necessity for, and the potential value of, the new association. At the convention held by the Railway Car Department Officers' Association at Chicago in August, 1927, T. W. Demarest, general superintendent of motive power of the Pennsylvania, Western Region, and chairman of the Arbitration Committee, stated that technical problems occupy an increasingly large portion of the time and effort of the Mechanical Division of the American Railway Association, leaving little opportunity for the consideration of important details formerly discussed by the old Master Car Builders' Association. Mr. Demarest said that there is great need for a national association of car department supervisors and inspectors, who can get together once a year and not only recommend changes in interchange rules, but make helpful suggestions for the betterment of car department conditions and operation in general.

The development of this national association suggested by Mr. Demarest and, in effect, enveloped with the mantle of the old Master Car Builders' Association, is now well underway. It should serve as a clearinghouse for the best ideas regarding efficient car department operation. With active and able leadership, reasonable care not to duplicate the work of other associations, and particular emphasis on general car department operation, as well as interchange rules, the new Master Car Builders' and Supervisors' Association should prove a valuable agency in carrying on the educational work among car department officers and supervisors. It is apparent that with these objectives in view the new association deserves the hearty support of higher mechanical department officers in order that the maximum benefits may accrue to the association, its individual members, and the railroads they serve.

The life of all-steel freight cars

A few months ago the Bessemer & Lake Erie established at its Greenville, Pa., shops, a permanent exhibit of four of the first freight cars of all-steel construction used in steam railroad service in this country. Two of the four are hoppers which were built in 1896. Since that time these cars have each travelled over 222,000 miles, largely in ore, coal and limestone service. The bodies of these cars are of the self-clearing hopper type, 30 ft. long, and have a capacity of 1,015 cu. ft. The trucks were originally of Fox design, having 4¾-in. by 8¼-in. journals. The axles were changed soon after the cars were purchased by the Bessemer to 5 in. by 9 in. to comply with the standards adopted by the Master Car Builders Association for 80,000-lb. capacity cars. Later 5½-in. by 10-in. arch bar trucks were substituted under one of the cars and the capacity was changed to 100,000 lb.

The repair records up to March 4, 1915, on the 100,000-lb. capacity car show that one pocket sheet was renewed in December, 1901, and three pocket sheets were renewed in April, 1905. In April, 1907, two side sheets were renewed and four floor angles spliced. In August, 1909, four side sheets, two side stakes and one pocket wing sheet were removed and four side stakes repaired.

In September, 1910, one side sheet was spliced and in May, 1911, two floor sheets and two floor sheet angles were renewed. A year later the car came into the shop for the renewal of one floor sheet and one floor sheet angle. The heaviest repairs made to the car since its construction were in September, 1914, after about 19 years of service, when a new floor, new divide sheets, eight pocket sheets, four side stakes, two corner side sheets, four floor angles, new hoods and six divide sheet angles were applied. Repairs were made to the sides of the car body at the same time. Five side stakes were repaired on March 4, 1915.

The record of repairs made to this car since March 4, 1915, is, in general, similar to the repairs made during

the first 18 years of the life of the car, except for the extensive repairs in September, 1914. In other words, the repairs since 1915 were to individual parts damaged by corrosion, accident, or wear-and-tear by unloading machinery. At no time during the 31 years' life of this car were copper bearing sheets applied, nor was it necessary to strengthen the center sill construction, the original center sills being 15-in. I-beams that have stood up well in service. With the exception of the repairs made in September, 1914, all repairs made during the first 19 years of its life were of a comparatively minor nature. The heavy repairs made in 1914 were essentially floor repairs and cannot be considered as a complete rebuilding. Many of the parts placed on the car originally, were still in service when it was retired.

It will be noted that the railroad pursued a policy of replacing parts as they became worn out, instead of tearing down completely and rebuilding as is the practice on many roads. This record would appear to be a good argument in favor of renewing or patching as each part becomes defective. There are, however, just as good reasons, and perhaps better, for tearing each car down completely when it comes into the shop for heavy repairs and rebuilding it with either new or reclaimed material. The latter policy appears to be in greater favor at the present time.

The general policy of steel car maintenance has an important bearing on the amount of equipment that a railroad must own and operate to meet traffic requirements. It is important that a railroad know, with a fair degree of accuracy, what the average life of a freight car on its lines should be. General conclusions cannot, of course, safely be drawn from a single instance. The Bessemer's exhibit at Greenville, together with the information that has been collected relative to the service life of the cars, affords an excellent opportunity to study the economics of an interesting life history involving a maintenance policy used by a minority of railroads. In addition, practically every railroad has available in its own car and stores department files, sufficient data by which a close estimate can be made of this economical life period. This information should be kept up-to-date and used as a check on the relative value of different designs and also to show which cars are receiving the most severe usage, especially that caused by unloading machinery.

What do you contribute?

In looking over the advance programs for the mechanical conventions this month one can hardly fail to be impressed by the scope of the subjects with which the associations are dealing, as well as by the high caliber of the men who have been induced to speak at the meetings. The steady increase each year in attendance at the several conventions is an indication of the appreciation of the value of attending such meetings. It is apparent from the programs that have been arranged that the officers and committee members of the several associations had been doing a vast amount of work during the past year. Their only reward for this work is the satisfaction of feeling that their efforts have contributed to an increase in mechanical department efficiency.

A convention program is divided into three general parts: The addresses by the principal speakers, the committee reports or individual papers and, possibly most important, the discussion of the reports or papers. An individual member cannot assume, with justice, that his obligation to the association has been fulfilled merely by his attendance. It is to be expected that most members are primarily interested in the benefit they personally will derive from the meeting. It is quite probable, however, that few individuals fully realize their obligations to the other members if they do not take cognizance of the fact that the greatest amount of good can not be accomplished without the participation in the discussion by a large portion of those in attendance.

The opinion has been expressed by one mechanical man that he does not feel that the amount of information which he has been able to obtain at a convention has in all cases justified the expenditure of time necessary to attend the meeting. This at first might seem like an unjust criticism and yet it is possible that many may be of this same opinion without actually expressing it. A railroad man, in dealing with the many complex problems that confront him, must be guided not only by his own judgment, but by the information that he may be able to obtain relating to the practices of other railroads. Frequently during the discussion of a subject points may be brought out that have not been given consideration by the committee or the individual who prepared the report or paper. In order to place on record a summary of the practices of different railroads in dealing with similar cases, the convention chairman invites discussion on the subject. It is quite possible that the opinion of some members to the effect that they have not profited by attendance is due to the fact that they may have made an unsuccessful effort to tabulate the practices of different roads from replies made by the several representatives during the discussion.

In all too many cases the discussion is allowed to wander from the point in question and the success of the discussion is dependent upon the ability of the chairman to direct the replies from the members on the floor into the channels for which information has been requested. The chairman, however, is helpless without the co-operation of the members. It is readily perceivable that in practically all of our conventions a comparatively small number of those in attendance take the initiative in discussion.

It is customary for most mechanical officers to request a report from their various supervisors on what transpired at a convention. In many cases these reports are undoubtedly discouraging, but the association is not to be criticised without taking into consideration the reasons for the lack of concrete results. An officer in authorizing the attendance of a number of his men at a convention does so with the feeling that his company is going to profit by it. His opinion as to whether or not such benefit has been received must, of necessity, be based upon the report which the man brings back. Instead of merely asking a man, after his return from a convention, "What benefit did you receive from your attendance at this meeting?", might it not be well to add another question, "What did you contribute to the success of the meeting?", or, "To what extent were you personally a factor in furthering the work of the association of which you are a member"?

No railroad expects a few men to run the road while the rest watch them do it and an association can not be the success that some think it should be until all the members contribute as much to the meeting as they expect to get out of it.

Pulverized coal locomotive built by the Allgemeine Elektricitats Gesellschaft, Berlin, Germany

Pulverized coal burners in Germany

Two experimental locomotives reported to be working satisfactorily in freight service—Results of tests started in 1924

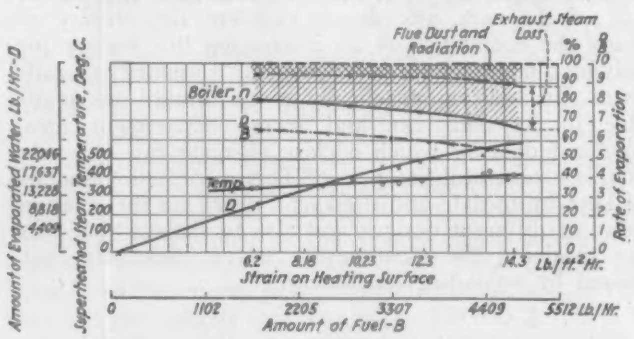
By Dr. Alfred Gradenwitz

IN 1924 the Allgemeine Elektricitäts Gesellschaft, Henningsdorf, Berlin, Germany, started developing a pulverized coal firebox for locomotives. A standard freight locomotive boiler was removed from a locomotive operated by the German State Railways and installed in a shed located over a working pit. By the fall of 1926, this boiler had given such satisfactory service that the A. E. G. company proceeded with the design of a pulverized coal burning locomotive. This

The tender

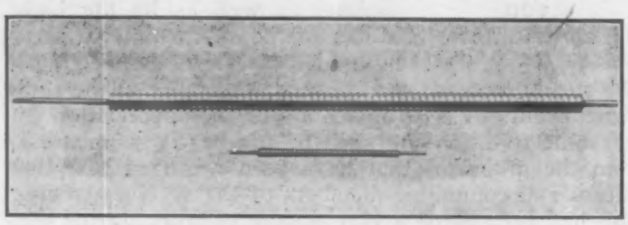
locomotive was completed the first part of 1927 and placed in experimental freight service in the latter part of July of that year. Since that time the locomotive has been handling freight trains on the main line of the German State Railways between the two points, Berlin and Fuerstenberg, a suburb of Mecklenburg.

As shown in one of the illustrations, this locomotive has the same external appearance as an ordinary loco-



Evaporation and boiler efficiency of boiler

motive with the exception of the tender, which is rather curiously shaped. The pulverized fuel is in a totally enclosed cylindrical horizontal container, and is mechanically conveyed to the firebox. The pulverized coal burns without smoke and with a total absence of sparks and, it is claimed, gives higher working efficiency than



Main and auxiliary conveying screws

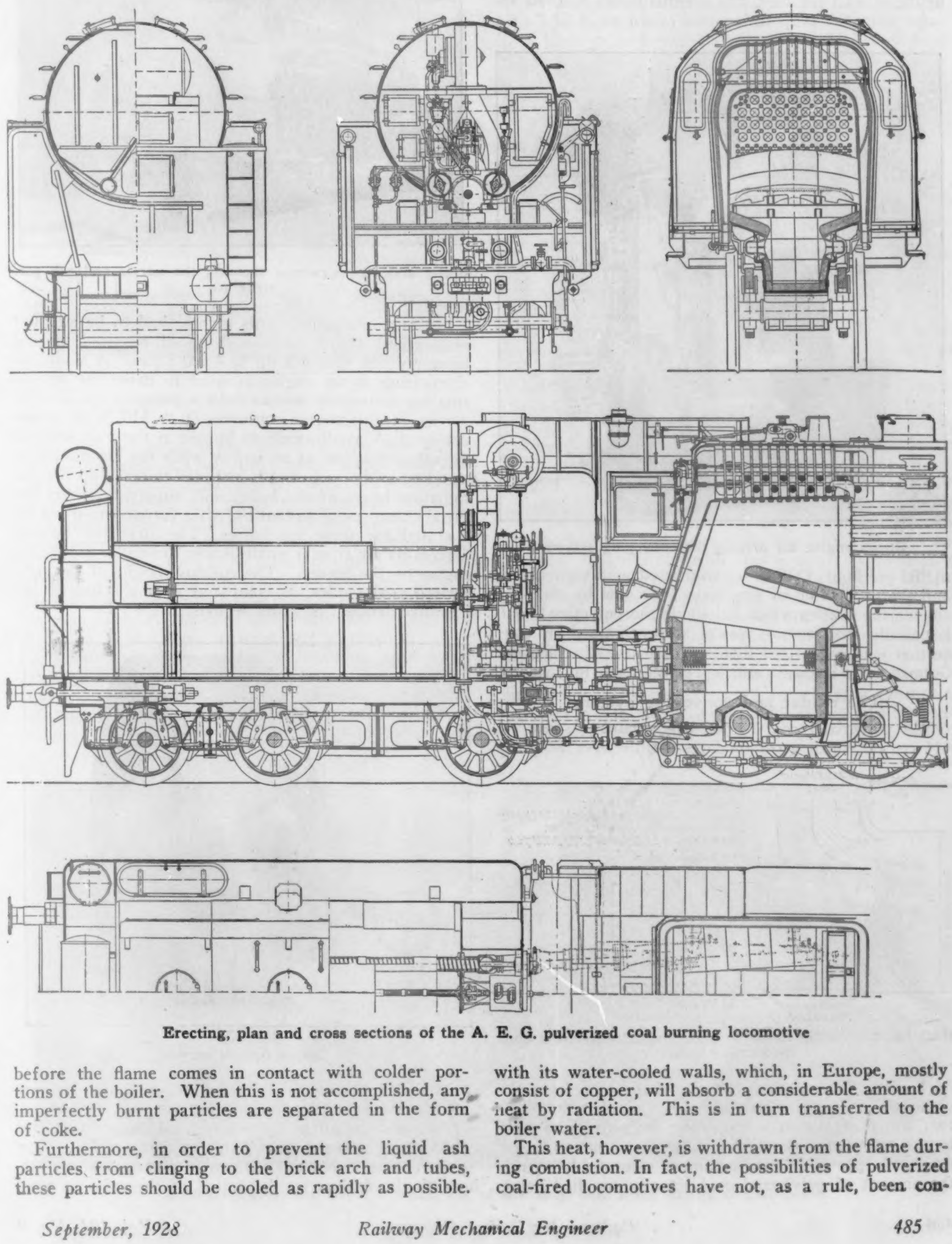
with ordinary grate firing. Poor quality fuel, such as small and waste coal, lignite, peat, etc., can be successfully employed for pulverized coal-fired locomotives, and should effect considerable economies in service.

To ensure perfect combustion of all combustible matter, the flame of pulverized coal furnaces should be so controlled as to have the combustion process finished before the flame comes in contact with colder portions of the boiler. When this is not accomplished, any imperfectly burnt particles are separated in the form of coke.

Furthermore, in order to prevent the liquid ash particles from clinging to the brick arch and tubes, these particles should be cooled as rapidly as possible. Pulverized coal furnaces, in order to comply with these conditions should have ample heating surface while the time of combustion should be from one to three seconds.

On account of the limited space available, the installation of pulverized coal furnaces in locomotive boilers, meets with particular difficulties. The firebox with its water-cooled walls, which, in Europe, mostly consist of copper, will absorb a considerable amount of heat by radiation. This is in turn transferred to the boiler water.

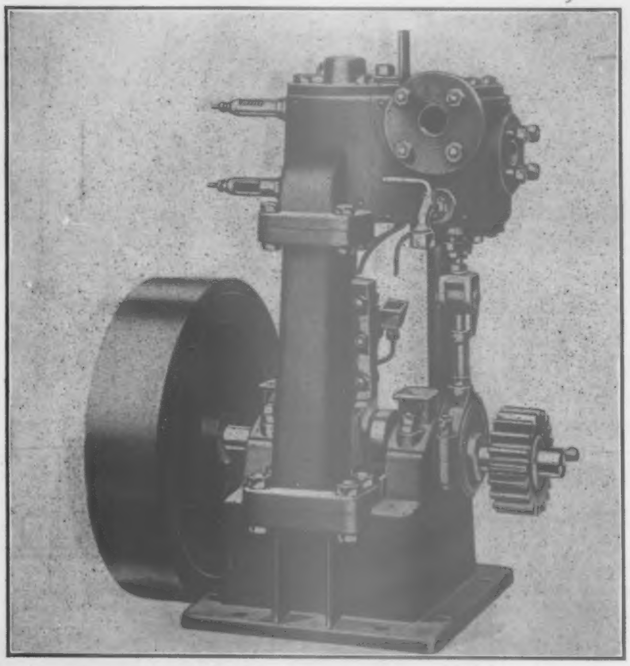
This heat, however, is withdrawn from the flame during combustion. In fact, the possibilities of pulverized coal-fired locomotives have not, as a rule, been con-



Erecting, plan and cross sections of the A. E. G. pulverized coal burning locomotive

sidered very hopefully. Locomotives of this type that have been built during the last ten years in the United States and Sweden, do not seem to have given satisfaction, no new units having been added during the past few years.

The efficiency of the boilers in the A. E. G. tests was raised from an initial figure of 67 per cent until a figure of 74.5 per cent was eventually reached. At the same time, the evaporation was raised to 14.32 lb. per

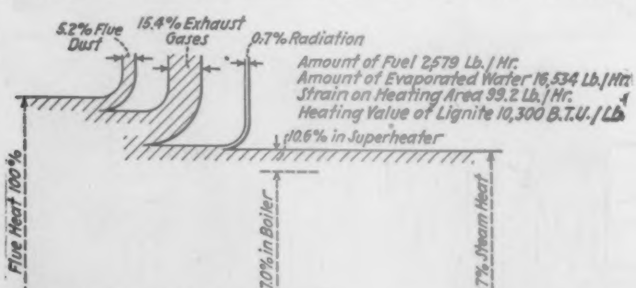


Steam engine for driving the conveying screws

sq. ft. per hour. Difficulties connected with combustion and the production of slag were overcome by choosing convenient nozzles which subdivide the pulverized coal. Especially satisfactory results were obtained in connection with pulverized lignite, to the use of which the German State Railways attached considerable importance.

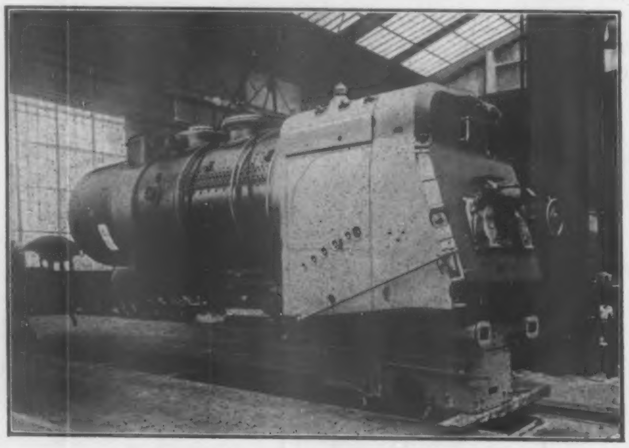
The tender and conveying system

The pulverized coal tender has a bunker space of 424 cu. ft. which accommodates a little over 5.9 tons



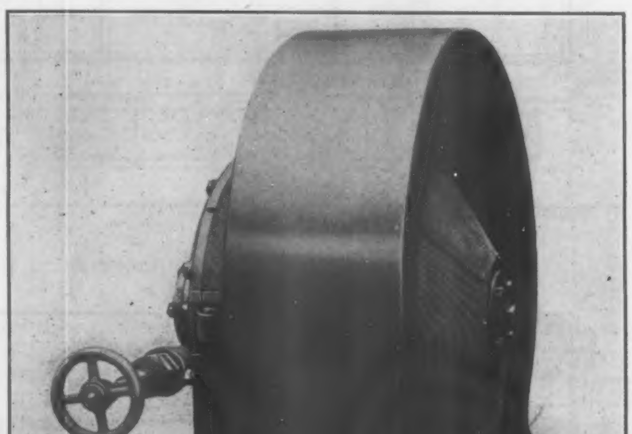
Heat balance of the A. E. G. experimental pulverized coal locomotive boiler

of lignite. The bunker has the shape of a cylinder about 6.5 ft. in diameter and 13 ft. in length. The two conveying screws, supplying the pulverized coal to the locomotive nozzles, will handle a maximum of 4,629.7 lb. per hour at a maximum rate of 140 r.p.m., the amount of pulverized coal actually supplied being controlled by regulating the number of revolutions of the conveying screws. A blower supplying the primary air is driven by a simple steam turbine, its output being



Boiler under construction showing the nozzle and ash pan structure

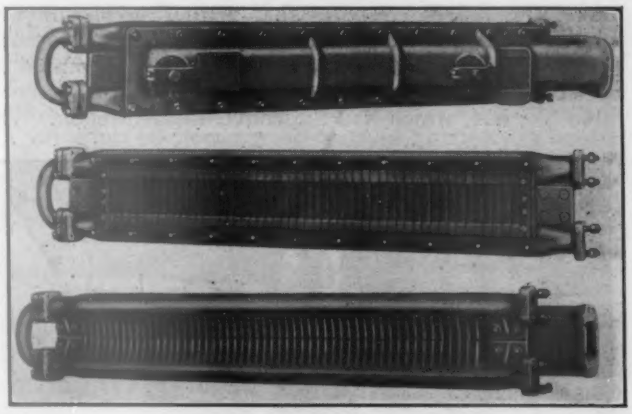
7 hp. as a maximum. This turbine had to be adopted on account of the very high speed required by the blower which operates up to 4,500 r.p.m. A small reciprocating steam engine is used to drive the slowly rotating conveying screws. At a pressure of 22.4 lb. per sq. in. this engine consumes 66 to 110 lb. of steam per hour. A small auxiliary burner at the rear wall of the ash pan serves as an igniter while the locomotive is standing or drifting, and is intended to make up for the radiation losses of the boiler and supplying steam for the air compressor so that the main furnace need not be operated for these auxiliaries. The auxiliary burner derives its air from a small blower driven by the steam engine on the tender. The surplus weight of the pulverized coal tender, as compared with a standard locomotive tender, is about 4 tons.



Steam turbine blower

The air and pulverized coal mixture which is blown into the firebox contains only part of the combustion air in the form of primary air, the balance; viz., the secondary air, being, as in any ordinary reciprocating steam engine locomotive, drawn in automatically from beneath the firebox by the action of the exhaust noz-

zle. The air and pulverized coal mixture is blown into two long nozzles facing each other from the sides of the pan below the firebox, through which it is delivered in a large number of narrow bands. These strike one another in the center of the furnace where a violent vortex is produced. The rising flames strike the preheated secondary air below the brick arch. The combustion chamber proper is surrounded with fire brick, with the arch above and the ash pan below, there being a possibility of heat radiation only on the side walls of the fire-

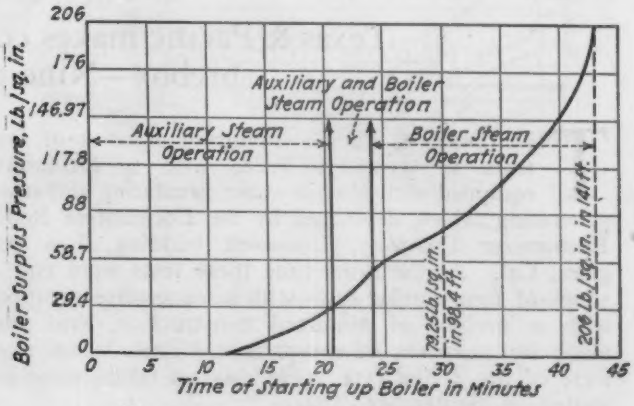


Several views of the nozzle

box. The hot gases at the end of the long arm are deflected upwards at a very high speed which causes the slag particles to be granulated on the crown sheet of the firebox, so that no slag clings to the ends of the tubes.

At the present time the A. E. G. has two pulverized coal locomotives of this design in operation which have, after a few trial runs at no load, been used for hauling freight trains on regular schedules over the Pankow-Heinersdorf-Loewenberg-Fuerstenberg - Mecklenburg-Strelitz line. A standard locomotive has always been included in the train to meet any emergency, but no occasion when it has had to be used has ever arisen. The pulverized coal locomotive has frequently pulled trains of 1,300 tons, in addition to hauling the standard locomotive of 115 tons, whereas the maximum tonnage allowed over the entire line is only 1,100 tons. Furthermore, the pulverized coal locomotive could always better the regular schedule time.

It sometimes occurred during some of the test runs, that pulverized lignite and pit coal were stored in layers one above the other in the tender. This condition of changing from one kind of fuel to another in course of



Rise of pressure in firing up the boiler

the trip never caused any inconvenience. Fluctuations in steam consumption could be easily taken care of under all fuel conditions.

The advantages claimed for the pulverized coal locomotive are as follows: The fuel cost is reduced by the possibility of using a lower grade of fuel, the possibility of using peat or lignite being a particularly valuable feature in German railroad operation. The most satisfactory results were obtained by using lignite, which contains a high percentage of volatile and can, therefore, be utilized to best advantage. The locomotive can use the kind of fuel most easily available and least expensive. The utilization of fuel is more complete than when used in a grate firebox, there being only half as much surplus air, the heating of which is a pure loss. A saving of 20 per cent is claimed for the boiler, which can be fired more rapidly than that of grate firebox boilers. The simple control of the furnace in accordance with the actual steam consumption is particularly important. The time required for cleaning the fire is reduced to a minimum, while there are no fuel losses in discharging the slag.

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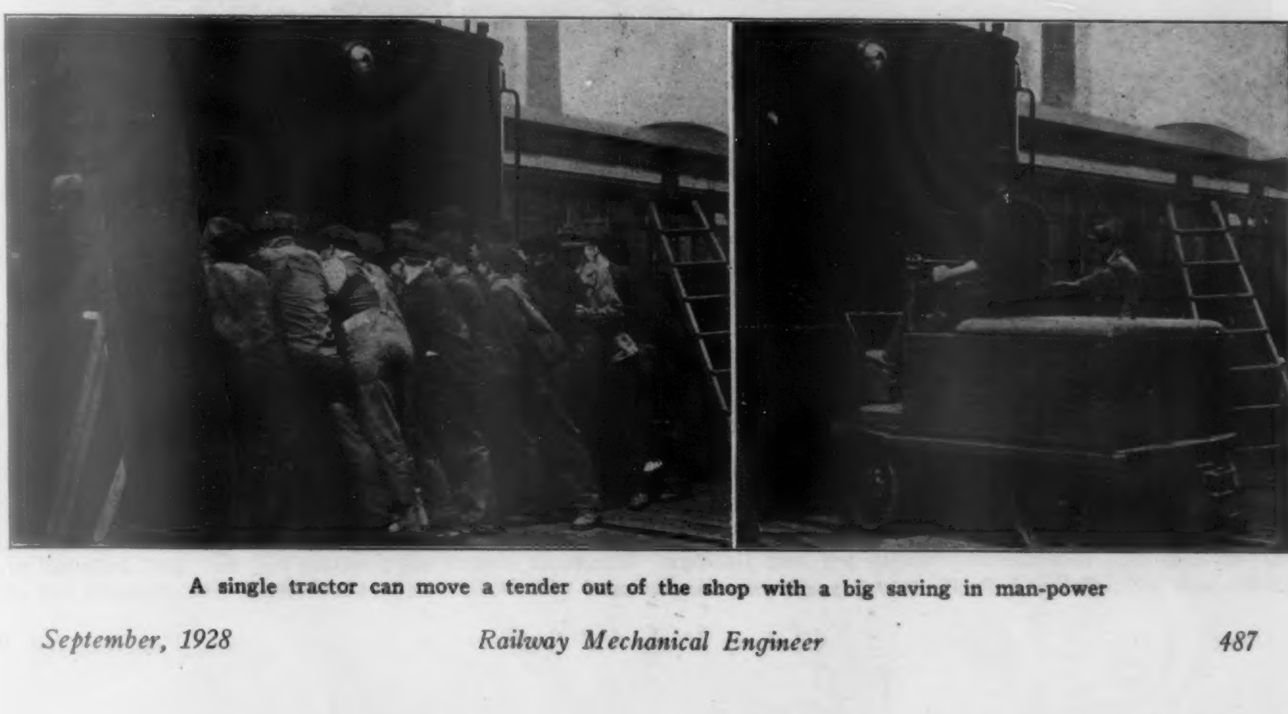


A single tractor can move a tender out of the shop with a big saving in man-power

Special firebox for oil-burning locomotives

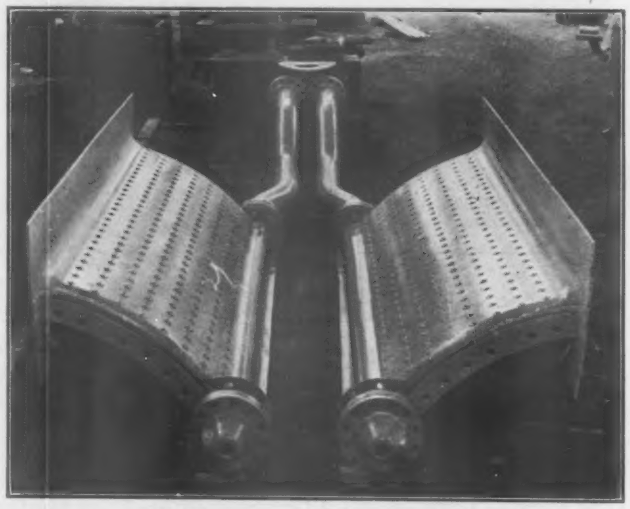
Texas & Pacific makes comparative tests with standard firebox—Nine per cent fuel saving

THE Texas & Pacific conducted a series of four tests in January, 1928, with a locomotive equipped with Martin water circulating and steam generating tables, developed by the Locomotive Boiler Economizer Company, Roosevelt building, Los Angeles, Cal. At the same time these tests were run, a series of four similar tests with a locomotive equipped with a firebox of standard construction, was also made for purposes of comparison. Both locomotives were of the 2-10-2 type. The Martin tables were installed in September, 1927.

The 2-10-2 type locomotive, No. 541, which was equipped with the Martin tables, has been operated in pooled freight service over different divisions during that period to ascertain its performance with a variety of boiler feed water. The comparative tests made last January for fuel performance with locomotive No. 534 of the same type and class, were made under adverse weather conditions, the temperature varying from 15 to 30 deg. F. during the tests with the Martin tables and from 55 to 70 deg. during the runs made with the locomotive equipped with the standard firebox. However, the railroad reports that a fuel saving of 11.2 per cent per 1,000 adjusted gross ton-miles was accomplished with locomotive No. 541, and it evaporated 14 per cent more water per pound of fuel oil than locomotive No. 534, which had the conventional firebox. The table gives a summary of the tests as reported by the mechanical department of the Texas & Pacific.

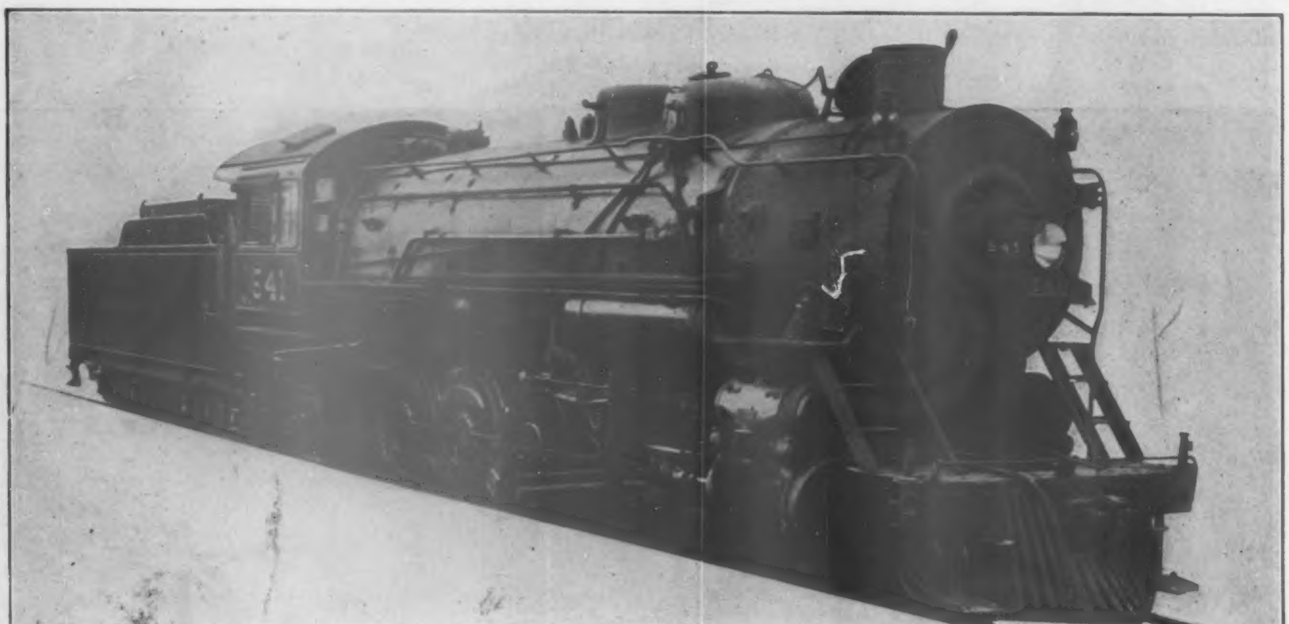
Results of tests comparing the Martin water-tables with a firebox of conventional construction

Description	Eng. 541 (Martin water-tables)	Eng. 534
Oil consumed per trip, gal.	1,946	2.180
Gals. oil per 1,000 g.t.m. (adjusted)	6.98	7.86
Gals. oil per 1,000 g.t.m. (adjusted)	6.98	7,86
Evaporation, lb. water per lb. of oil	11.89	10.42
Time on road	5 hr. 55 min.	6 hr. 20 min.
Actual running time	4 hr. 34 min.	4 hr. 24 min.
Per cent of rated tonnage handled entire trip	97.35	97.05



Martin water-circulating and steam-generating tables ready for application

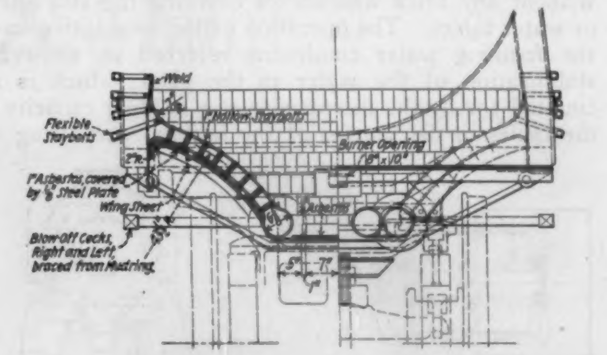
From this table it will be noted that the fuel saving effected was substantial. In addition to the fuel saving



Texas & Pacific 2-10-2 type locomotive equipped with Martin water-circulating tables

in road service, there is a material saving in fuel oil used at terminals in firing-up. A test at Big Spring, Texas, of locomotive No. 541 versus a standard equipped locomotive of the same class, showed that there was a saving of approximately 42 gal. of oil in bringing the two locomotives up to the same gage pressure, all conditions being equal. This is accounted for by the fact that the tables, in addition to the sides, crown sheet and combustion chamber, begin to absorb the heat from the flame of the oil burner as soon as the fire is lighted in the firebox. The circulation of the water from the shell of the boiler through the tables and water legs causes the water to absorb the heat at a more rapid rate than a boiler equipped with a firebox of standard construction. The table construction eliminates the dead end to the mud ring, and the objection to firing up oil burning locomotives hurriedly, with the consequent strain to the firebox sheets, is eliminated.

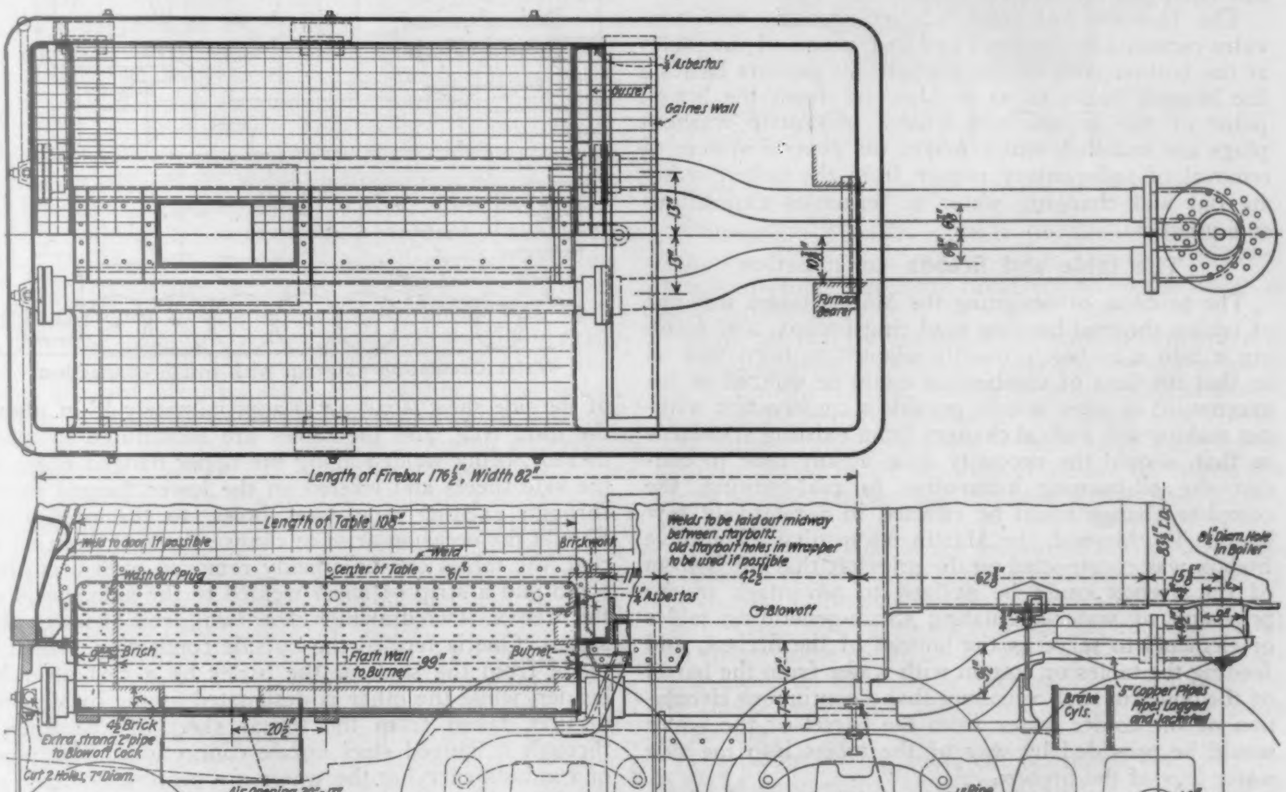
It will be noted from the drawings that the water tables present bare water carrying surfaces to the fire, which surfaces were previously covered with fire brick. No fire brick are used on the side sheets of the firebox or on the tables, and it will also be noted that only a burner wall, flash wall and bottom floor between the bulbs or mud drums of the tables is used. An oil burning locomotive firebox equipped with these tables, eliminates the direct attachment of the side sheets of the firebox to the mud ring, substituting in lieu thereof a longitudinally running expansion joint occasioned by the juncture of the table with the side sheet. The tables, with the side sheets, form a loop which is brought around and secured by the bottom flange of the tables to the mud ring. In this manner, the strains incidental to the expansion of the side sheets are effectively compensated and bulging of the sheet under the heat of the firebox, causing it to move inwardly toward the fire and off the staybolts, is entirely done away with by the elimination of the direct attachment or anchorage of the side sheets to the mud ring.



Cross section through the firebox

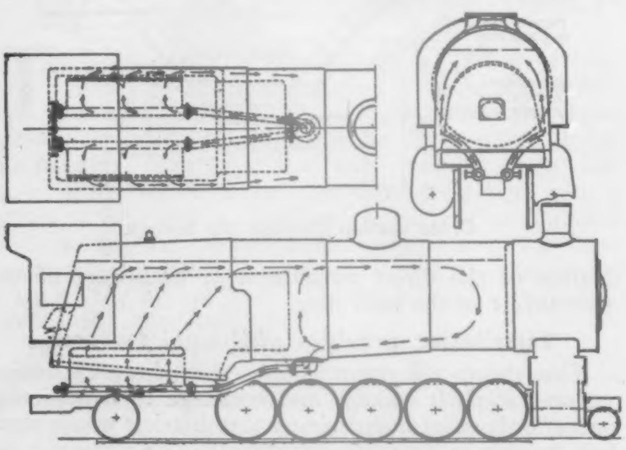
Installation provides additional features

This means of compensating side sheet expansion reduces staybolt leakage and breakage to a minimum and affords relief in foaming water districts where staybolt trouble is greatly aggravated. The value of the water table construction in preserving the integrity of the firebox sheets was practically brought out in the operation of locomotive No. 541 between Big Spring and Toyah, Texas, in the foaming water district of the Rio Grande division where, owing to the shortage of rainfall and the highly concentrated condition of the water supply, it was necessary to brick the side sheets



General arrangement of the water circulating table installation on the Texas & Pacific 2-10-2 type locomotive

of locomotives equipped with conventional fireboxes of the same class six rows of staybolts high, whereas locomotive No. 541 operated under the same conditions without any brick whatsoever covering the side sheets or water tables. The operation of the locomotive under the foaming water conditions referred to, showed a stabilization of the water in the glass, which is accounted for by the increased water holding capacity of the tables in the bottom of the firebox, permitting the engineman to better control the water than in the standard equipped locomotive.



Water circulation diagram with outside connection

The blowoff and wash-out arrangement also provides certain advantages. The construction of the tables at the bottom ends of the mud drums permits locating the blowoff cocks so as to blow off from the lowest point of the firebox and boiler. Adequate washout plugs are installed, which makes the general system of removal of sedimentary matter from the boiler, washing out and changing water at terminals expeditious and practical.

The table and firebox construction

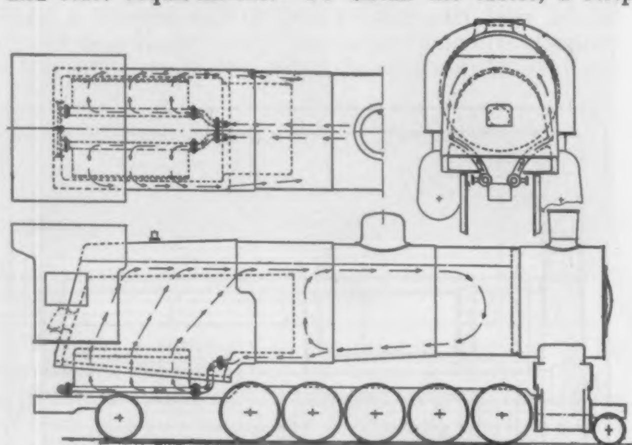
The problem of designing the Martin tables was one of taking the coal-burning mud ring firebox, and forming it into a firebox primarily adapted to burn fuel oil so that the heat of combustion could be utilized to the maximum; in other words, provide a construction without making any radical changes from existing standards so that, should the necessity arise at any time to convert the oil-burning locomotive to coal-burning, the complete change could be effected in a relatively few hours. To this end, the Martin oil-burning locomotive firebox was constructed on the principle that the bottom of the firebox could be utilized to advantage in the provision of water-circulating steam-generating tables or elements to serve as the bottom of the firebox, and feeding the tables or bottom with water from the barrel of the boiler in such a manner that a continuous circulation of the colder water from the barrel of the boiler would be provided by way of the tables into the side water legs of the firebox.

The effect of this is a dual one, in that the tables not only increase the active heating surface in the bottom of the firebox, but are the means of causing active circulation of the water in the side legs, which is ordinarily dormant a considerable distance over the mud ring and, because of being dormant, requires the protection of a refractory brick covering along the side sheets.

The circulatory movement of the water from the barrel of the boiler through the water tables into the water legs is occasioned by the difference in thermal head existing between the colder water in the shell of the boiler and the heating of this water in its passage through the tables. The result is that the water is lightened in the side legs by steam bubbles and is continually displaced by the colder water from the boiler barrel. The water tables act as generating surfaces not only to cause the active movement of the water through themselves but cause the steam line to be brought down the water legs from below the crown sheet, thereby materially increasing the capacity of the side sheet heating surfaces.

The object of this construction was to provide oil burning locomotives with a simple and efficient arrangement without any radical departure from the present standards, while taking advantage of all of the properties contained in the combustion of fuel oil. With this point in mind, the water tables are curved downward below the mud ring to form the deepest possible combustion chamber and to present convex surfaces to the fire. In this manner the firebox combustion volume, which is important in burning gaseous types of fuel such as fuel oil, is maintained at its maximum.

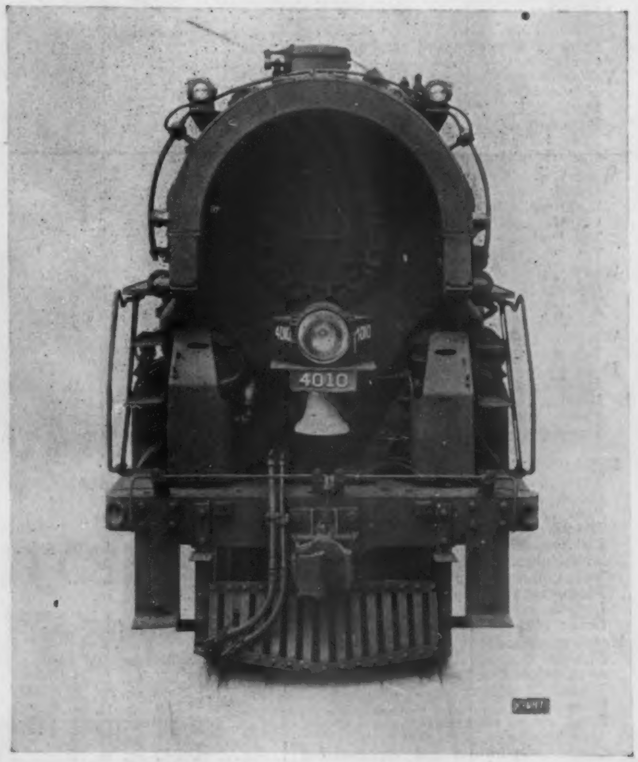
The illustrations show how the tables are constructed. They provide a continuation of the water legs of the firebox when attached by their flanges to the side sheets and mud ring, and are built in accordance with federal and state requirements. To install the tables, a strip of the side sheet is cut away approximately 18 in. above the mud ring, and the tables are substituted in place thereof, being welded along the upper flanged edges to the side sheets and riveted on the lower flanged faces, through existing ring rivet holes, to the mud ring. Should the occasion arise to change the fuel from oil to coal, the tables can be quickly removed with a cutting torch and a strip of sheet welded to the side sheets of the firebox. Two drawings show two forms of water passages. One is termed the outside connection, which is made from the shell of the boiler by a cast steel Y-header, while the other is designated as the inside connection, taken from the throat sheet of the firebox through a flanged steel nozzle connection. The pipes or conduits carrying the water are preferably made of copper and in accordance with the rules and regulations of the Department of Commerce for high-pressure pipes on ocean-going vessels. The copper pipes readily adapt themselves to all strains of expansion and contraction, and on this account are ideal water carriers. They carry cast steel flanges which are in turn secured to the cast steel flanges provided at the lower front ends of the tables. The cast steel flanges on the tables also carry cast steel blowoff headers, to which the right and left blowoff cocks are attached.



Water circulation diagram with inside connection

Twenty 2-8-4 type locomotives for the Boston & Maine

Develop a tractive force with booster of 81,400 lb.—Innovations in the design of spring saddles, frame pedestals and cab interior



Front end of the locomotive, showing the Coffin feedwater heater

THE Boston & Maine has placed into service 20 2-8-4 type locomotives designed to handle fast freight or to enter passenger service if needed. These locomotives, built by the Lima Locomotive Works, Inc., parallel closely the general design of the Lima A-1 locomotive. A glance at the table giving a comparison of the principal dimensions of the A-1 with the new B. & M. 2-8-4 locomotives, shows that the principal difference lies in the weights in working order. The total engine weight of the A-1 is 385,000 lb., while that of the B. & M. locomotive is 393,000 lb. There is a slight increase in favor of the B. & M. locomotive in the total evaporative heating surface, which can be attributed to the inclusion of two Nicholson thermic syphons on the B. & M. locomotive. The factor of adhesion for the A-1 is 3.58 and for the B. & M. locomotive is 3.6. The rated tractive force is the same for both locomotives.

The purchase of these locomotives was prompted by a necessity for speedier and more flexible operation, and a desire for the most economical performance, both from the fuel and maintenance standpoints. These locomotives will be operated on the Fitchburg division, between Mechanicsville, N. Y., the western gateway of the Boston & Maine, and Boston, Mass. Later, when the present bridge building and strengthening program is completed, they will be used on the Portland division, making through runs from Mechanicsville, N. Y., to Portland, Me., a distance of approximately 300 miles.

On the Fitchburg division, westbound, the ruling grade is on Ashburnham hill, near Gardner, Mass., about midway between Mechanicsville and Boston. The grade, which is about 12 miles long, averages about 1.22 per cent which, with curve allowance, gives an equivalent compensated grade of 1.25. Eastbound, the ruling grade is .91 per cent. The Portland division, over which these locomotives will later operate, has no grade problem.

These locomotives will reduce the running time of a 75-car train from Mechanicsville to Boston, a distance of 210 miles, by two hours. This run will be made without the services of a helper engine.

These locomotives weigh 393,000 lb., of which 250,200 lb. is on the drivers and 104,000 lb. on the four-wheel articulated trailing truck. They carry 240 lb. boiler pressure and, with a maximum cut-off of 60 per cent, develop a tractive force of 69,400 lb. Including the booster, which drives on the rear pair of trailing wheels, the total tractive force is 81,400 lb.

Boiler equipment

Aside from the size of the firebox, which has a grate area of 100 sq. ft., the boiler does not differ materially from the usual type of design. It is of the extended wagon top type, the first course of which is 88 in. in diameter and the third course 94 in. The boiler is provided with a Type E superheater and Chambers front-end throttle. The dry pipe is provided with a main shut-off valve in the dome for use in case repairs on the throttle or superheater are necessary when the boiler is under pressure.

There are two turrets from which steam is distributed to the auxiliaries, both located over the top of the boiler just in front of the cab. One of these furnishes saturated steam to the injector, lubricators and steam heat system. The other draws superheated steam from the throttle pipe connection to the superheater header for use in the air compressor, stoker, booster, headlight turbine, blower and whistle.

The petticoat pipe in the smokebox has a blower arrangement in the bottom periphery instead of connecting the blower to the exhaust nozzle, which is of the Goodfellow type. Owing to the location and construction of the steam dome incidental to the front-end throttle arrangement, an auxiliary inspection dome is located on the course next to the firebox to facilitate interior boiler inspection.

The boiler lagging studs are welded to the boiler instead of being tapped in. The lagging is covered with a jacket made from copper-bearing steel.

The machinery

The boiler is supported on frames made of manganese-nickel cast steel. The pedestal toes are of minimum depth and made wide enough to take collared pedestal studs which, in conjunction with the outer pedestal bolts, hold the pedestal cap in place. This arrangement draws the cap directly to the toes and eliminates the

fulcrum effect at the toe and consequent flexure of the cap found in the usual application. The key arrangement at the frame and saddle fit is the double wedge type with a bolt.

All of the pedestals are equipped with Franklin automatic wedges with parallel-faced floating plates and single taper wedges. The shoes are made of special bronze.

Table of dimensions, weights and proportions of the Boston & Maine 2-8-4 type locomotives

Railroad	Boston & Maine
Type of locomotive	2-8-4
Service	Fast freight
Cylinders, diameter and stroke	28 in. by 30 in.
Valve gear, type	Baker, long travel
Valves, piston type, size	14 in.
Maximum travel	8¾ in.
Outside lap	2⅝ in.
Exhaust clearance	1/16 in.
Lead in full gear	¼ in.
Cut-off in full gear, per cent	60
Weights in working order:	
On drivers	250,200 lb.
On front truck	38,800 lb.
On trailing truck	104,000 lb.
Total engine	393,000 lb.
Tender, loaded	216,400 lb.
Wheel bases:	
Driving	16 ft. 6 in.
Total engine	41 ft. 8 in.
Total engine and tender	80 ft. 3¾ in.
Wheels, diameter outside tires:	
Driving	63 in.
Journals, diameter and length:	
Driving, main	12 in. by 14 in.
Driving, others	11 in. by 13 in.
Front truck	6½ in. by 12 in.
Trailing truck	Front, 6½ in. by 12 in. Rear, 9 in. by 14 in.
Boiler:	
Type	Wagon top
Steam pressure	240 lb.
Fuel	Bituminous
Diameter, first ring, outside	88 in.
Firebox, length and width	150⅛ in. by 96¼ in.
Arch tubes, number and diameter	2—3½ in.
Tubes, number and diameter	86—2¼ in.
Flues, number and diameter	204—3½ in.
Length over tube sheets	20 ft.
Grate area	100 sq. ft.
Heating surfaces:	
Firebox	284 sq. ft.
Arch tubes and two syphons	121 sq. ft.
Tubes	1,008 sq. ft.
Flues	3,718 sq. ft.
Total evaporative	5,131 sq. ft.
Superheating	2,111 sq. ft.
Comb. evaporative and superheating	7,242 sq. ft.
Special equipment:	
Superheater	Type E
Feedwater heater	Coffin, Type C
Stoker	Dupont Simplex, Type B
Booster	Franklin
Tender:	
Style	Rectangular
Water capacity	12,000 gal.
Fuel capacity	18 tons
General data estimated:	
Rated tractive force, 60 per cent	69,400 lb., with booster, 81,400 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	64.2
Weight on drivers ÷ tractive force	3.6
Total weight engine ÷ comb. heat. surface	54.3
Boiler proportions:	
Tractive force ÷ comb. heat. surface	9.58
Tractive force × dia. drivers ÷ comb. heat. surface	604
Firebox heat. surface ÷ grate area	4.05
Firebox heat. surface, per cent of evap. heat. surface	7.8
Superheat. surface, per cent of evap. heat. surface	41.2
Comb. heat. surface ÷ grate area	72.42

Design of spring saddles on driving boxes

The spring saddles on the driving boxes are designed to bear on the ends and not in the center. This feature assures a stable setting of the saddle and eliminates uneven wear on the saddle seat and consequent relining with inserted plates. Eventual wear can be taken care of by building up with autogenous welding and then machining.

The main rods, side rods, driving axles and crank pins are made from normalized carbon-vanadium steel. The rod arrangement is the Lima tandem extended main rod type with floating bushings on the main pins.

The locomotives are equipped with commonwealth ashpans with horizontal sliding doors and a mechanical dump. This ashpan is supported in the frame of the articulated four-wheel trailing truck, on which is also mounted a Franklin booster. The Franklin power reverse gear is synchronized with the booster.

Method of lubrication

The locomotives are equipped with eight-feed, force-feed lubricators for lubricating the steam chests, guides and air compressor steam cylinders. A hydrostatic lubricator provides lubrication for the Simplex Type B stoker and booster. All of the valve gear bearings are provided with Bassick Alemite high-pressure grease fittings. Speedee grease cups are used on the rods.

Water supply

Water is supplied from the left side of the tank through the Coffin feedwater heater and from the right side through a non-lifting inspirator. A thermometer well is located in the feedwater heater delivery pipe to facilitate taking feedwater temperatures when desired. The shut-off valve in the pipe from the cylinder exhaust to the feedwater heater is equipped with a locking device to insure the valve remaining open at all times while in service.

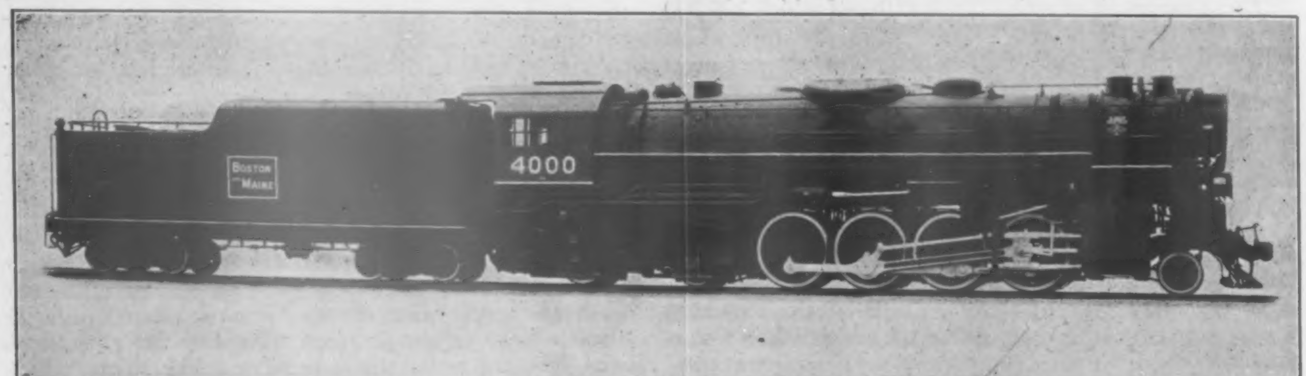
Barco flexible metal joints are used between the engine and tender for air and steam heat connections. The air, signal and steam heat terminals at the rear of the tender are secured on movable supports which afford flexibility in lateral movement.

Steam heat and air signal equipment were applied to permit incidental passenger service without preliminary preparation.

Cab equipped with lockers and fireproof lining

The cab is lined with fireproof Agasote. Metal sash is used on the sides. Each cab is equipped with a clothes locker.

The locomotives are equipped with continuous automatic train control.



Boston & Maine 2-8-4 type freight locomotive

A marked increase in steaming range and power followed front-end changes in this modern Missouri Pacific locomotive

The locomotive front-end in its relation to fuel economy

Suggestions for effective front-end arrangement are developed as a result of extensive Missouri Pacific tests

By J. R. Jackson
Engineer of tests, Missouri Pacific, St. Louis, Mo.

THE Missouri Pacific, in common with many other rapidly developing roads, had purchased new power of a heavier and more powerful design up to 1926 without particular study or attention to the design of the front-end. The locomotive builders have not given attention to the design of the front-end and, in building new power for the railroads, have a tendency to work in standard parts such as stacks and nozzle stands based on existing patterns or necessitating minor pattern changes, rather than to design new parts in proportion to the locomotives to be constructed. This tendency, extending over a period of years, has resulted in a gradual reduction of the size of the stack in proportion to the rapid increase in size of the boiler and cylinders and has resulted in some poorly proportioned front-end arrangements and obstructed exhaust passages and openings in otherwise modern locomotive designs.

Starting in the fall of 1925, a series of tests was conducted by the Missouri Pacific on one of its standard Mikado locomotives to determine whether or not improvement could be made in the front-end arrangement then standard. Locomotive No. 1557, selected as representing the Mikado locomotives placed in service during that year, was equipped with the latest modern appliances, including a locomotive booster. It has 27-in. by 32-in. cylinders, 63-in. drivers, 190 lb. boiler pressure, 67 sq. ft. of grate area, 250,000 lb. weight on drivers and 68,675 lb. tractive force with the booster.

As received from the builders, the front-end arrangement, as shown by Fig. 1, consisted of an 18-in. outside stack and a 14-in. single-sleeve petticoat pipe inside the smoke-box. The nozzle stand, 28¾ in. high, was designed to include the booster exhaust around the main locomotive exhaust. It was found that with this front-end arrangement, the locomotive would steam with a 6-in. open nozzle tip under all conditions of operation except when the booster was cut in on a sustained pull. Under these conditions the steam pressure would drop from 25 to 30 lb. and the engine would lose water after from 5 to 7 min. of booster operation. It was also found that with the 6-in. open nozzle tip the back-pressure was excessive and showed as high as 25 to 30 lb. per sq. in. when working the engine hard at speed, and did not relieve the engine properly when worked to capacity at drag speeds on heavy grades.

The first step towards improving the steaming range of the engine was to replace the 18-in. stack with a 20-in. stack extended down into the smoke-box in the form of an inside sleeve to replace the petticoat pipe previously used. With this arrangement, the original high nozzle stand was retained, but the piping of the booster exhaust was changed to remove it from around the nozzle tip and carry it up through an independent connection outside of the stack. This modified arrangement resulted in an appreciable improvement in the steaming qualities of the engine and it was possible to increase the size of nozzle tip from 6 in. successively to 6¼-in., 6⅜-in. and 6½-in. in diameter. The latter size gave a nozzle

opening greater than that at the choke in the nozzle stand casting, so that opening the tip beyond 6⅜-in. had no effect towards reducing the back pressure on the engines.

The next step in the tests was to replace the standard high nozzle stand with a new design, approximately 20 in. high, so designed as to give more area through the base of the stand and make it possible to increase the size of nozzle tip. A series of test runs was then made with 6¼-in., 6⅜-in. and 6½-in. open nozzle tips and it was found that the engine would steam effectively with a 6½-in. open nozzle tip and maintain steam pressure with the booster cut in on sustained pulls, but that there was still a tendency to lose in water when the booster was worked constantly.

The third step in the development of our present standard front-end arrangement, as based on the tests made with locomotive No. 1557, was to increase the size of the stack from 20 in. to 22 in. After the installation of the 22 in. stack, all other details remaining the same, the series of tests previously made with the 20 in. stack were repeated. It was found that the larger stack gave a good steaming and self-cleaning front-end arrangement with a 6½-in. open nozzle tip, the stack was well-filled under all conditions, the smoke was well-elevated and the engine was powerful on the hills and ran freely on the level. Pyrometer readings, however, indicated that the temperature of superheat developed was not as high as it shoul dbe, and this was overcome by the substitution of a netting table plate for the solid plate previously used.

This change increased the superheat and improved the steaming of the engine to such an extent that the nozzle tip was increased to 6⅝-in. and then to 6¾-in., without bridge or other obstructions of any kind.

The final development of the front-end changes as applying to locomotive No. 1557, and now standard for all Mikado locomotives on the road, is shown by the sketch in Fig. 2.

Former front-end arrangement inefficient

The conclusions arrived at after the tests conducted on locomotive No. 1557, which extended over several months, were that the then standard front-end arrangement used on our Mikado locomotives was wasteful of power and fuel by reason of the excessively restricted nozzle tips necessary for satisfactory steaming with the size of stack, petticoat arrangement and height of exhaust pipe used.

The successive changes, which resulted in increasing the size of the stack and lowering the height of the exhaust pipe and necessary changes in the table plate arrangement, resulted in a sufficient increase in capacity and saving in fuel to pay for the changes in a short time and were the basis for corresponding changes in the front-end arrangements of all locomotives of this class which have subsequently been made.

It was demonstrated during the tests with locomotive No. 1557, and has been substantiated with other locomotives of this class since changed, that by increasing the areas of the nozzle tip and improving the steaming by the use of the modified front-end it has been possible to handle the tonnage ratings of 1926 with ease and to increase appreciably the tonnage that can be economically handled by these engines on certain districts.

Comparative performance tests

A few months after the completion of the front-end tests with locomotive No. 1557, this engine was put in good mechanical condition and tested in comparison with the Missouri Pacific experimental three-cylinder locomotive No. 1699 and the Lima A-1 locomotive. These tests were made over the Illinois division between Dupo and Bush during the mid-winter of 1926-27, handling coal tonnage. The only change in the front-end arrangement of locomotive No. 1557 prior to these tests was to replace the 6¾ in. open nozzle tip with a 7-in. tip fitted with four short diamond projections extending over the nozzle opening. These projections with the 7-in. tip gave practically the same effective tip areas as with the 6-¾ in. open nozzle previously used, but the projections acted to increase the surface area of the jet and give a better entrainment of gases and more uniform filling of the stack under certain conditions. The same size and type of tip was used on the three-cylinder locomotive No. 1699 during these tests; the stack and front-end arrangement on this engine had been previously changed to duplicate that found most satisfactory in the tests with locomotive No. 1557 on the Eastern division. Both locomotives steamed exceptionally freely throughout their operating range, and with relatively low back pressure as recorded during these tests.

A dynamometer car, leased from the Kansas City Southern, was used to make a complete record of draw-bar pull, speed, actual work done, and the method of

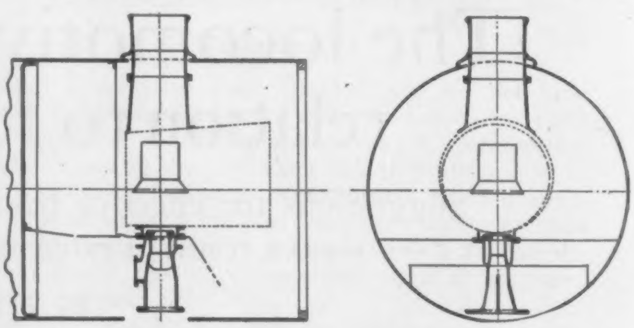


Fig. 1—Former Missouri Pacific standard type of front end

working the engine; throttle position and cut-off, boiler pressure, superheat, branch pipe and exhaust pressures, were recorded on the chronograph roll in the dynamometer car along with time, distance traveled, and other records pertaining to locomotive operation and train handling.

The tests on the Illinois division were made during mid-winter, and the weather conditions during the runs with locomotive No. 1557 in particular, were extreme. This gave ample opportunity to demonstrate the steaming capacity and general performance of the locomotive under adverse conditions; it was not a "fair-weather" test by any means and, owing to the condition of the rail, outside temperature and wind, it was necessary to work the engine to capacity and have a free steaming engine to handle the tonnages in the test trains over the division.

Based on seven northbound dynamometer-car test trips handling coal trains over the 101.3 miles betwen Bush and Dupo, the average train handled consisted of 8,000 actual tons in 122 loads. These heavy coal trains were at an average running speed of 14.3 m.p.h., 9 hr. 45 min. total time on the road, with 2 hr. 41 min. average delay, making 7 hr. 4 min. average running time. The average fuel consumption was 55.2 lb. of coal per 1,000 gross ton-miles, which, considering the adverse weather conditions and heavy trains,

is a remarkable figure when considering this territory.

On one memorable trip, made on January 13, 1927, handling 8,452 actual tons in 128 loads, the rail was extremely bad all the way and rapidly getting worse as the trip progressed. It was necessary to use the booster repeatedly even on the river grade between Gorham and Dupo, to hold the speed because of the engine slipping on the bad rail, but this heavy train was handled through in 10 hr. 15 min. total time, or at an average speed of 11.2 m.p.h. running time in the face of a blizzard which tied up the division for a few hours last night. Several trains handling much lighter tonnage which followed the test train were frozen up.

It was demonstrated by these dynamometer-car tests on the Illinois division that the changes in the front-end arrangement, employing the larger stack and the low nozzle stand with increased exhaust passages, made possible increasing the economical tonnage that can be handled by this class of engine, as compared with the same engines with the old front-end arrangement, by nearly 20 per cent on this particular division.

Passenger locomotive tests

After the front-end test with locomotive No. 1557 over the Eastern division during 1925-26 the same principles were applied in making changes in the front-end arrangements of our 6600 class and 5300 class passenger power, operating on the Eastern and Missouri divisions. In the case of the 6600 class locomotives with 27-in. by 28-in. cylinders, the stacks were increased from 18 in. to 20 in. in diameter and low nozzle stands were substituted for the original high stands coming with these engines. These changes made possible the

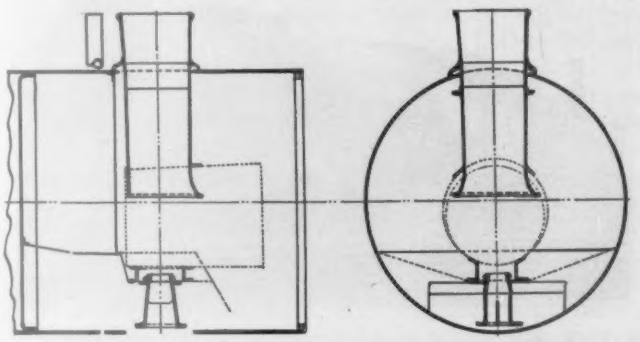


Fig. 2—Present standard type of front end on the Missouri Pacific

increasing of the average nozzle sizes in these locomotives from 6 in. or less to an average of 6⅜-in. open, and these locomotives are now being run with tips (with four diamond prongs) giving an equivalent area to about the 6⅜-in. open tips, on coal and oil burners.

During May, 1926, changes in the front-end arrangement of a Mountain type locomotive with 27-in. by 30-in. cylinders, No. 5307, operating over the Missouri division, were made to demonstrate the value of corresponding changes to this class of power. By the substitution of a low nozzle stand with ample exhaust passages and later increasing the stack from 18 in. to 20 in., it was possible to increase the size of nozzle tip opening from 6⅜-in. to 7-in. open. These changes in this class of locomotive resulted in a marked increase in steaming range and power for handling the heavy trains over the mountains on the Missouri division, as evidenced by the ease with which these locomotives, after the front-end changes, handled the trains without pusher over the ruling grades, where before a pusher was considered necessary. As a result of these tests all locomotives of this class were changed to correspond to Locomotive 5307.

When the new 1720 class locomotives were built on the Omaha division during July, 1926, the front-end arrangement was based on the results of the tests then being completed with locomotive No. 1557. On these new Santa Fe type locomotives, with 30-in. by 32-in. cylinders, low nozzle stands and 24-in. stacks were specified. These engines are now being run with 7⅝-in. nozzle tips fitted with four diamond projections. They steam freely with low average back pressure.

The new Mountain type 5335 class passenger locomotives placed in service last summer have low nozzle stands and 22-in. stacks. These locomotives, with 27-in. by 32-in. cylinders, carry 250 lb. boiler pressure and are steaming and running freely with 7⅝-in. open nozzles, or the equivalent in effective area with four diamond projections.

The new 1156 class Pacific type locomotives purchased last year at the same time as the new 5335 class are duplicates, as regards boilers and front-ends, of the 6600 class and were received from the builders with the low nozzle stands and 20-in. stacks found effective with the older engines of the class.

What is required of the front end

Present day practice in America demands a two-fold function of the locomotive front-end arrangement. First, a proportioning and adjustment of parts which will make possible a free steaming locomotive in the service assigned and with the grade of fuels supplied; and, second, that this free-steaming arrangement also prevent live sparks or cinders of sufficient size to be thrown from the stack to start fires along the right-of-way but at the same time give a self-cleaning front-end, namely, one which will not fill up with an accumulation of cinders in making a trip over its operating territory.

The third and most important specification for a satisfactory front-end arrangement, and one that is not generally attained, is that the exhaust passages and nozzle tip opening should be of such design and area as to relieve the engines properly under all conditions of operation and thus avoid excessive back pressure and consequent loss in power in the locomotive cylinders and sluggishness of locomotive operation.

Given a set of uniform or fixed conditions, it would be possible to design a size of stack and nozzle tip to realize all these conditions of drafting in a most efficient manner, but since a locomotive is operated under extremely variable load conditions as influenced by train loadings, grade variations, speed and weather conditions, it is apparent that any design of front-end arrangement must represent a compromise that will give satisfactory results through a rather wide range of operating conditions and oftentimes with a considerable variation in the quality of fuel.

Drafting for fuel economy

While it is required of the front-end arrangement on any given locomotive to furnish the necessary draft to make that locomotive a free and economical steamer, it does not at all follow that if the locomotive does not steam, it is the fault of the front-end. Air leaks around the steam pipes, the front door ring, the stack base, the cylinder saddle joint and bolt or stud holes, may be such as to cause a serious loss in draft through

allowing atmospheric air to pass directly into the smoke-box instead of through the fire bed. If the flues become stopped up with cinders or the air openings through the grates are stopped up with slag, the balance in draft is disturbed and the steaming of the locomotive affected. Leaking superheater joints or steam pipes will also affect the steaming of a locomotive to a greater or lesser degree, depending upon the character and location of the leak.

It is of prime importance to have the grates properly designed and fitted, and kept clean in order to insure uniform distribution of air through the fire; if a portion of grate bar is broken off or the spaces between adjacent bars is unevenly divided, a uniform fire cannot be carried. Having a difference in pressure between two inter-communicating points, the flow will always be from a high pressure to a low pressure through the path of least resistance. If there are unequal openings through the grates or if a portion of the grate is blocked by clinkers or slag, flow of cold air through the openings or through the unclinkered section of the grate will be excessive, and poor steaming and the pulling of large particles of unburned fuel into the smoke-box will result.

The function of the netting

It is the function of the netting in the front-end arrangement of all coal-burning locomotives to prevent the discharge of cinders or sparks larger than will pass through the standard mesh. Larger particles pulled into the smoke-box are trapped behind the netting until broken up by repeated impacts against the netting. The front-end netting will take care of a normal amount of cinders, but if the grates are shaken when the engine is working hard on a heavy grade, large particles of unburned fuel will be pulled into the front-end and cause a filling up and plugging of the netting. Holes in the fire or a cocked or broken grate will do the same thing.

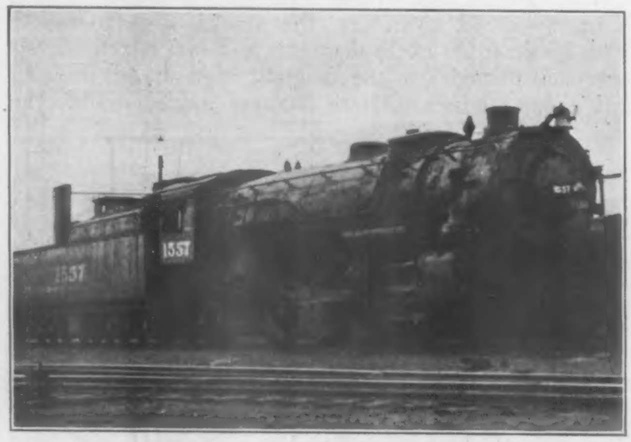
Water getting into the smoke-box while the engines are standing at terminals may result in a plugged netting because of sweating when the engine is fired. To prevent this trouble, cylinder cocks should be opened before engines are moved and excess water drawn from the house blower line before it is connected. A plugged netting will cause a loss in draft and is a rather common cause of hard steaming or steam failures.

It is dangerous practice to use the squirt hose to break up clinkers in the fire-box. The clinkers should not be broken up by this practice, as it is hard on the grates and arch, and tends to cause honey-comb, which plasters the back tube sheet, and is liable to crack side sheets.

Effect of reducing the diameter of the nozzle tip

If an engine has been previously steaming and is reported as not steaming an investigation should be made to determine the cause of the trouble and make the necessary repairs if any leaks are found. Poor steaming may be chargeable to the fireman and therefore be a man failure. The favorite remedy for poor steaming is to reduce the nozzle tip diameter and this is often done without consideration of what it means in efficiency. Too often the nozzle is reduced in diameter to overcome air or steam leaks, or stoppages in grates of flues, which should have been repaired. There is no excuse for reducing a nozzle tip more than 1/8 in. at a time.

It is commonly accepted practice that it is necessary to reduce the size of the nozzle tip during the winter months to prevent steam failures. When we stop to consider the facts of the matter the fallacy of this practice will be evident. If a locomotive is steaming freely with a proper size nozzle to fill the stack and relieve the locomotive under summer operating conditions, it should be left alone. The only difference between summer and winter as regards train resistance is that the resistance will increase in winter. This means that it will require more power to handle the same tonnage in winter than was necessary in summer or, in other words, the engines will have to be worked harder. This being true, why reduce the area of the tip and thus increase the back pressure? The difference in the temperature of the atmosphere as between summer and winter (100 deg. at most) is so small in relation with the temperature of the fire-box (2500 to 3000 deg F.) as to require no change in drafting conditions. Since it is a well established fact that, other things being equal, a locomotive worked hard continuously will steam better with a large nozzle than with a small nozzle, it would appear that if any change in the nozzle size is to be made to take care of winter conditions, the area should be increased rather than decreased as is commonly thought necessary. The rational thing to do, once the proper size of nozzle is established as best for steaming and back pressure relief, is to leave it alone regardless of seasonal changes.



Front-end tests were begun on this locomotive

A check of the nozzle sizes in the same class of engines operating on almost any territory on the road will show such variation in tip areas as to prove that nozzle changes are made without regard to any well-established practice. With the size of stacks increased, the size of the nozzle tip must not be reduced beyond the point where the exhaust jet will fill the stack, and it is too often the case that the size of tip was reduced in accordance with the old rule, where the proper move would have been to increase it to improve steaming conditions.

Economy in fuel consumption

The Missouri Pacific management has set up a goal for fuel economy during the coming year which may be attained if all concerned with the handling of fuel do their part towards fuel conservation.

Predicated on the extensive front-end tests with Locomotives 1557, 5307, 6612 and other representative

power, the mechanical department has now made changes in practically all its latest freight and passenger power, and incorporated these principles in all power purchased since 1926. These changes have increased the steaming range and improved the power and running of these engines, and if properly maintained, efficiently run and economically fired, fuel economy is bound to result. With motive power in good shape, and a fairly uniform grade of steam coal available all over the railroad, with the train tonnage kept up as near the maximum as business conditions will permit and train dispatching handled to start trains out of terminals advantageously and keep them moving enroute, we should be able to make a fuel record that will be a credit to all concerned and a gratification to our management.

Comparison of American and British railway practices

A champion of American methods takes up cudgels in their behalf

By "A Man From Texas"

THE questions raised by the correspondent on page 183 of the April issue as to the relative merits of American and foreign railway practices have, in the past, occasioned a great deal of acrimonious controversy and have been responsible for the circulation of much misinformation.

Passenger train speeds

We can scarcely dispute the claim that the fastest individual passenger schedules, and the longest non-stop runs, are, at present, performed on English railways. In their 1927 summer time-tables will be found 141 daily non-stop runs, ranging from 100 to 268 miles in length. Scheduled speeds as high as 61.8 m.p.h., over a distance of 77.3 miles (start to stop), and numerous runs timed at more than 50 m.p.h. are listed. The great majority of non-stop runs, however, are under 150 miles in length, and the number of exceptionally fast trains is but a very small percentage of the total number of passenger trains.

It is far from correct to base an opinion of any country's passenger train service on the performance of a few unusually-fast short-distance trains, most of which are run for competitive or advertising purposes. As an illustration, consider France and Germany in 1914. Although the French lines ran a number of trains at speeds far and away beyond anything in Germany, yet the average schedule speed of *all* the first- and second-class express trains in Germany was but 1.1 m.p.h. less than that of the corresponding classes of trains in France.

So, in America, while we run few trains at average rates of more than 45 m.p.h., we also have few scheduled at less than 25 to 30 m.p.h., and a general average of all our passenger train schedules would probably show a figure that would compare favorably with average English speed, without even considering the difference in traffic and geographical conditions. Exceptionally high speeds over the long distances prevailing in the United States would inevitably mean light tonnage and heavy fuel consumption, particularly on lines having difficult gradient profiles. The British main lines generally have far easier gradients than ours, as will be understood from the fact that the greatest altitude reached by a standard gage railway in the British Isles is 1,485 ft. above sea level.

Non-stop runs

The longest non-stop runs at present performed in England are as follows:

Longest non-stop runs in England

Road	Miles Run	Time, Hours
London, Midland & Scottish—London and Carlisle	299¼	5¼
London & North Eastern—London and Newcastle	268.3	5½
Great Western—London and Plymouth	225.7	4

But the contest is not yet settled; the L. & N. E. Railway is building tenders having a gangway through the center, and a vestibule connecting with the coaches, to permit changing crews en route, so that trains may be run from London to Edinburgh, 392.7 miles, without an intermediate stop.

It must not be supposed that such feats are impossible in the United States. Fifty-two years ago, a little 4-4-0 engine and train ran 438.5 miles without a stop from Jersey City to Pittsburgh over the Pennsylvania Railroad, creating a record that still stands. Under American conditions, such runs are not regarded as profitable commercial propositions; consequently, we forego them, not because they are impossible of achievement, but simply because they do not pay. They require, in addition to the necessary number of long-distance passengers, a double-track line and the installation of track troughs, and, if excessive delays to other trains are to be avoided, a considerable proportion of triple and quadruple line must be provided. There are few American railways equipped with the above-mentioned refinements, but they have a density of freight traffic so great that it is totally incomprehensible to most Englishmen. To insert a 300-mile high-speed non-stop run, in the midst of this traffic, would disrupt the schedules of the entire line.

American train dispatching

It is sometimes argued that the English method of working trains is better adapted to the performance of long non-stop runs at high speed than is our train-dispatching system. Any possible disadvantages of train-dispatching in this regard are outweighed by other more valuable considerations. It may not be generally known that American train-dispatching, introduced into France by the army during the World War, has been gradually extended over 3,500 miles of the French main lines.

With reference to the fastest New York-Chicago

trains, it is no secret that their time was increased from 18 to 20 hours some years ago; not owing to "inferior equipment," but to prevent interference with other traffic. The fastest long-distance run in England, that between London and Glasgow, 401.4 miles, is done at the rate of 49.1 m.p.h., as against 48.2 m.p.h. for the fastest New York-Chicago train, so it seems that we would gain little by adopting English equipment and track in this case.

Track structure

The rails used on the several British main lines are of the "bullhead" type, 45 to 60 ft. in length, varying in weight from 95 to 100 lb. per yard, and secured by wooden "keys" or wedges into cast-iron "chairs" which are, in turn, fastened by bolts or screw-spikes to treated ties spaced from 30 to 34 in. between centers. The rail-joints are opposite each other, not staggered as in American practice. Among the railways of the world this type of track construction is restricted almost exclusively to the British Isles and parts of India.

The "flat bottom" or "T"-rail, which reigns supreme elsewhere, makes a far less costly track and generally carries heavier axle loads per pound of rail. It should be pointed out, nevertheless, that the general restriction of axle loads in England to 45,000 lb. implies the ultra-conservatism of British civil engineers, and the obsolescence of many of their bridges, rather than any weakness of the track structure.

Accident statistics

As regards the statement that American accidents and casualties are ten times greater than on British roads, it must not be overlooked that we have more than ten times the railway mileage that exists in Great Britain. We have nearly three times as many locomotives, and we run three times as many total train-miles. Our freight trains are three times as long and five times as heavy as those of England. All these factors have a great influence on accidents and casualties, but they are seldom considered by those who make invidious comparisons. Most of the exaggerated statements in circulation at present are based on the number of revenue-paying passengers actually killed in English passenger-train collision and derailments, compared with the total deaths of all kinds on American roads, including employees, trespassers, etc. The unfairness of this requires no comment.

The locomotive question

It is in connection with the locomotive that the most vitriolic attacks on American railway practice are made. The foreign locomotives are usually so "far superior" to ours that any argument on specific points of superiority would be superfluous. The Britisher who has had the responsibility of operating and maintaining English, American and Continental locomotives under colonial conditions, is not always so sure of the overwhelming superiority of the English product. There are several Englishmen who will defend bar frames, steel fireboxes, rocking grates and grease lubrication.

The length of life of American locomotives in foreign lands depends largely on the state of mind of the person in charge of them. If the engines are entrusted to the care of individuals hostile to all things American, the result can be forecast beyond a doubt. During 1899-1900 a large number of locomotives of typical American design were sent to England. Eighty 2-6-0 freight engines built for the Great Central, Great Northern, and Midland Railways were consigned to the scrap heap after only 10 to 15 years. Other locomotives, built at the same time, for the Barry Railway and for the Port Talbot Railway and Docks Company, are in use today; some of them still having their original boilers. Numerous similar examples could be quoted, both favorable and unfavorable to American engines as compared with British from the standpoint of longevity, but they would serve no useful purpose. We will, therefore, confine ourselves to the consideration of one quotation, which any American will regard with pardonable pride:

> "Engines of American design . . . . . have always given most efficient service in New Zealand, a statement which certainly seems to be proved by the fact that, of the original 14 engines of classes "K" and "T", all are still at work, although the earliest are now 44 years old." *

Undoubtedly these engines have been in the hands of their friends.

Life of locomotives

It is difficult to arrive at an accurate estimate of the average life of British locomotives, since some of them are rebuilt so often that they finally contain hardly a piece of the original machine. The late Wilson Worsdell, chief mechanical engineer of the North Eastern Railway, once said that English passenger engines lasted approximately 25 years, during which they ran from 700,000 to 1,000,000 miles. In exceptional cases, this has been greatly exceeded. There is record of one English engine which ran 2,318,918 miles during its life of 29½ years. But, since the recent grouping of British railways quite a number of comparatively modern and efficient locomotives, both freight and passenger, have found their way to the scrap heap after far less than 25 years of service.

Although many American engines are scrapped because traffic requirements have outgrown them before they are worn out, it is still possible to find locomotives from 30 to 35 years old on most American railways. About five years ago, certain American periodicals published a statement that the Bureau of Valuation of the Interstate Commerce Commission had made an analysis of the serivce rendered by more than 8,000 steam locomotives used on nine large western railways in the United States, and that the average length of life was found to be 34½ years. This demonstrates that, if considered necessary and economical, our locomotives can attain an old age. We must also bear in mind that the average annual locomotive mileage in the United States is somewhat greater than in foreign countries.

Copper vs. steel fireboxes

From 1860 to the present day, experiments with steel fireboxes have been almost continuous in England. Why the earliest boxes were a complete success while all the others have been failures, still remains a riddle to Englishmen. But some of them must be convinced that steel has other advantages besides the highly important one of low first cost; otherwise trials would have ceased long since. In view of the general failure of steel boxes in England, it seems very peculiar that hundreds of British-built steel fireboxes are used successfully on the railways of Africa and South America, under conditions far more arduous than are ever encountered in England.

The first cost of a copper firebox is not only five

* "Locomotives of the New Zealand Government Railways." Locomotive Magazine—1921, page 8.

or six times as great as that of a similar steel box, but if the engine does much hard work at long cut-offs, and burns a friable coal, the copper plates will suffer serious abrasion. This trouble was, in some degree, responsible for the introduction of the steel firebox on American railways. The fact that this difficulty is not experienced in Great Britain is due principally, no doubt, to the admitted superiority of English coal, but it also tends to indicate that the locomotives are not worked as hard as ours. Consider, for instance, the engines used on the 299¼-mile non-stop run previously mentioned. Three round-trips with a dynamometer car were recently made over this route with an average trainload of 482 short tons. At an average start-to-stop speed of 51 m.p.h., the mean power at the tender drawbar amounted to 690 hp. And this is considered a marvellous performance for a three-cylinder, superheated 4-6-0 engine, weighing 190,000 lb.

Complaints regarding "constant trouble" are not confined to American engines only, as is demonstrated by the following quotation:

"The European locomotives were laid up for repairs 2½ times as long as the American for the 4-4-0 locomotives, twice the time for the Consolidations, and no advantage either way for the Moguls. These examples are not picked, but are an average of all engines at this particular shed, which stables 54 engines." *

While there is no machinery in existence that does not require constant attention and repairs, we need not be ashamed of the relative performance of the American locomotive in this regard. In spite of the extremely careful treatment accorded to British locomotives in their enginehouses, the American engine can boast of much greater average mileage between shoppings for general repairs.

The steaming qualities of a properly designed locomotive are principally dependent on three factors: The fuel, the fireman, and the ability of the mechanical officials to make suitable adjustments of the drafting appliances on the locomotive. The third factor is very often the weak link in this chain, but in such cases the blame is rarely placed where it belongs.

Interchangeability of locomotives

In regard to the ability of American locomotives to run on British rails, we have already noticed a number of them that performed such service successfully for periods varying from 10 to nearly 30 years. Certainly, the British railways could accommodate none of the recent locomotives of any American railway; not because of the "rigid roadbed", but because our axle loads and clearance limits are far beyond those permissible in England. An absolute maximum of 45,000 to 49,500 lb. per axle, and a clearance of 13½ ft. in height by 9½ ft. in width seem dwarf-like to American eyes. So far as rigidity is concerned, the frozen roadbed prevalent in some parts of the United States during the winter months would seem to equal anything England can offer in comparison.

It will be readily admitted that any system of spring rigging which fails to include equalizing levers would not be a conspicuous success on American track. Even in England, opinion is divided on this important matter. While the great majority of British locomotives have individual springs for each wheel, with no system of equalization whatever, the Great Western Railway has incorporated the so-called "compensating-levers" into the spring rigging of practically all of the engines which it has built during the past 25 years.

Locomotive frames

It is somewhat surprising to find that the correspondent made no reference to the bar type of frame, sometimes contemptuously alluded to as a "trellis-work". This is a veritable bugbear to the orthodox school of British engineers. But, however much the English dislike the bar frame, they are often compelled to use it in locomotives constructed for their colonies. It has a strong foothold in Africa, and is gaining ground in Australia.

In Germany, the plate frame is no longer considered for new construction. After an inspection of some American locomotives, which were built for the Bavarian State Railways about 1900, the late Anton Hammel was deeply impressed with the possibilities of the bar frame, and he soon made this type of construction a specialty of the Maffei Works. Most of the Bavarian State Railway locomotives built since 1903, and the majority of Prussian locomotives built since 1917, have had bar frames, and they are also specified for the 16 standard types of locomotives recently designed for the German State Railways—the greatest railway system under one management in the world. In the case of plate versus bar frames for heavy modern locomotives, there is little room for argument. The opinion of those who have conscientiously tried both, is overwhelmingly in favor of the bar type.

* "The Locomotives of the Rio Grande do Sul Railway." Locomotive Magazine, 1912, page 174.

Steam Tables.—The properties of saturated and superheated steam, from 0.0886 to 3,300 lb., absolute pressure, are given in the booklet of steam tables published by the Superheater Company, 17 East 42nd street, New York. A heat-entropy diagram is also included among these tables which have been reprinted from the new seventh edition of the handbook entitled "Superheat Engineering Data".

Railway purchases in the United States in 1927 totaled $2,168,000,000, an amount equivalent to $78.60 for each family in this country, according to a statement by L. A. Downs, president of the Illinois Central. The expenditure for current purchases—material and supplies—was $1,396,000,000 while $72,000,000 was spent for new equipment and additions and betterments to fixed property.

The railroads spent $439,000,000 in 1927 for coal alone, the statement continues. Every fourth dollar earned by the coal miners last year came from the railroads. The railroads spent $433,000,000 for iron and steel products. Employees of the iron and steel industry derived approximately one-fifth of their income from that source. Railway purchases of lumber, ties, poles and other forest products in 1927 amounted to $176,000,000. One-fourth of all the wages paid in the lumber industry came from the railroads.

One hundred fifty-nine plants, employing more than 62,000 wage earners, are engaged in building locomotives and cars for railway use, in addition to the many other plants engaged in the manufacture of railway supplies. These plants in turn are also extensive purchasers of other products, such as coal, iron and lumber, thereby distributing widely the money the railroads pay them.

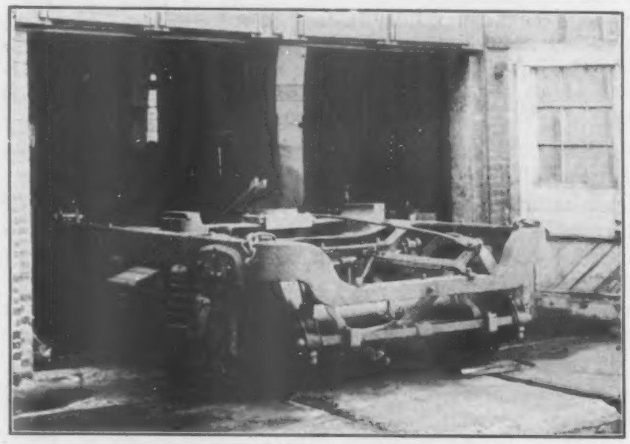
Added to these major items are many other products used by the railroads, including nearly every conceivable type of material and supplies. When the railroads suffer a decline in earnings they must necessarily curtail their purchases, buying only such items and such quantities as are imperatively needed to keep their plants in operation. Their restricted buying is immediately reflected in curtailed activity in other industries. On the other hand prospering railroads are able to renew their facilities, replace old equipment and undertake needed improvements, all of which create demands for the products of other industries and has a beneficial effect upon business generally.

Rock Island passenger-car shop devices save labor

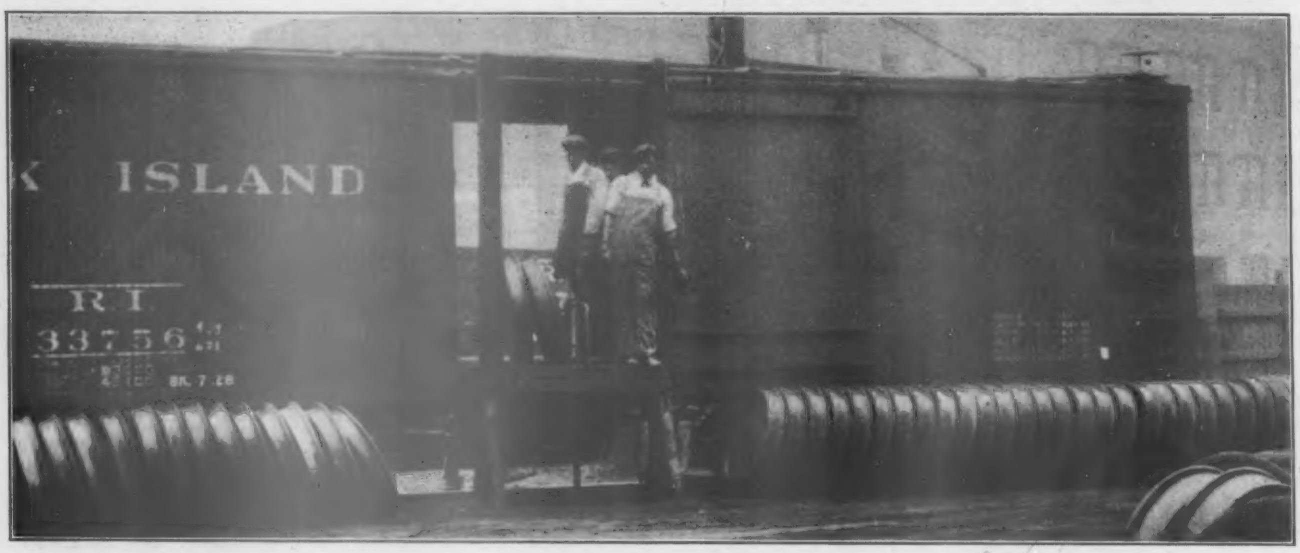
PASSENGER-CAR work, which develops on the Chicago, Rock Island & Pacific in the Chicago territory, is handled at the Forty-seventh street passenger-car shops. While these shops are no longer new, and many of the operations are practically identical with those carried on in other passenger car-shops throughout the country, a considerable number of labor-saving methods and devices have been developed, some of which may not be generally known.

A great many car wheels have to be handled, and arrangements have been made so far as possible to reduce the manual labor in moving these wheels. A lift for loading and unloading car wheels from box or flat cars is shown in one of the illustrations, conditions making it impractical to have a car floor platform or depressed tracks. The lift consists of a platform about four feet square, arranged for vertical movement in a suitable frame by means of an 8-in. by 50-in. cylinder set in the ground underneath. In the lowered position, the surface of the lift is flush with the platform and a number of wheels can be readily rolled into position on it. Operation of an air control valve admits air to the cylinder and causes the lift to move upward to the level of the car floor, the wheels then being easily rolled to the required position inside the car.

In the truck shop also, every effort is made to save labor, numerous jib cranes and hoists being available where needed. Complete trucks can be lifted, or any truck parts. There are two tracks in the truck shop, both of which have pits extending the entire length to



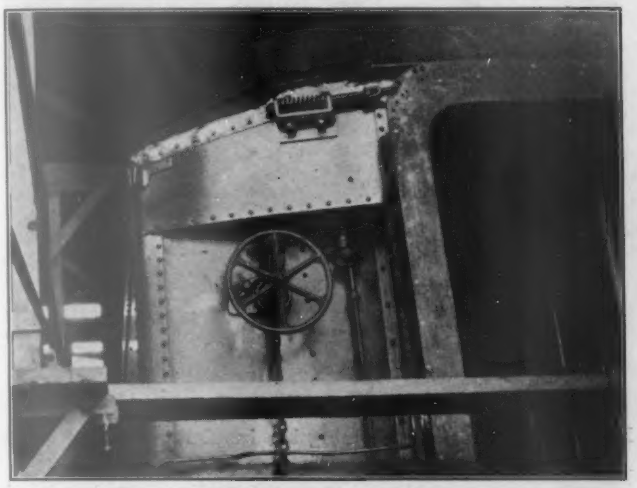
Truck ready to leave the shop



Car-wheel lift at Forty-seventh street (Chicago) shops of the Chicago, Rock Island & Pacific

facilitate underneath work. Two six-wheel trucks can be accommodated on each truck. Dollies, equipped with air cylinders and arranged to move on narrow tracks in each pit, greatly assist in the removal or reapplication of springs or, in emergency, can be used for changing truck wheels.

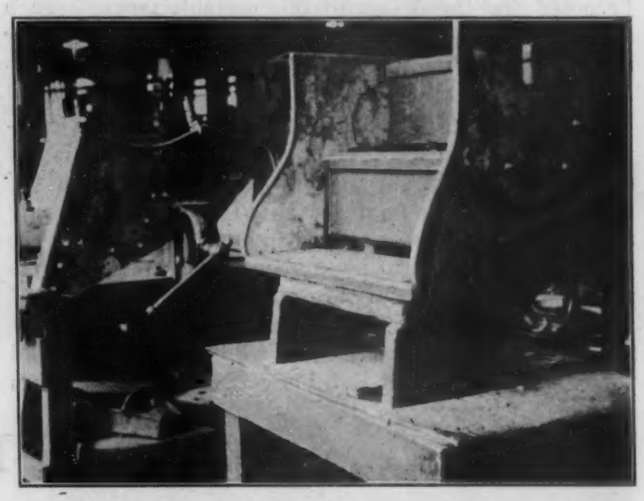
At the present time, several cars are being practically



Method of patching corroded roof corners

rebuilt at the Forty-seventh street shops. These are wooden cars with steel underframes, which are being completely remodeled on the interior, with new floors, roofs and interior trim, and steel plates applied on the exteriors. The object is to convert old cars into essentially modern all-steel equipment. A large amount of heavy sheet metal work is required, and the shop is equipped with machinery, and numerous devices for carrying on this work.

The method of handling step repairs and, when necessary, building new passenger-car steps, shown in one of the illustrations, is a typical labor-saver. Step treads, risers and skirts are secured in the proper amount, depending upon the number of steps to be made. The skirts are sheared to the proper shape, with holes punched, as needed. The nosing, which consists of split 3/8-in. pipe, is then bent to conform to the shape of the skirt and riveted in place. Assembling takes place on a set of false wood steps slightly narrower than the standard car steps and mounted on a table so as to bring the assembly work at the proper height for convenience. The treads, risers and skirts of each set of passenger-car steps can then be readily bolted and



False steps used in assembling passenger-car steps

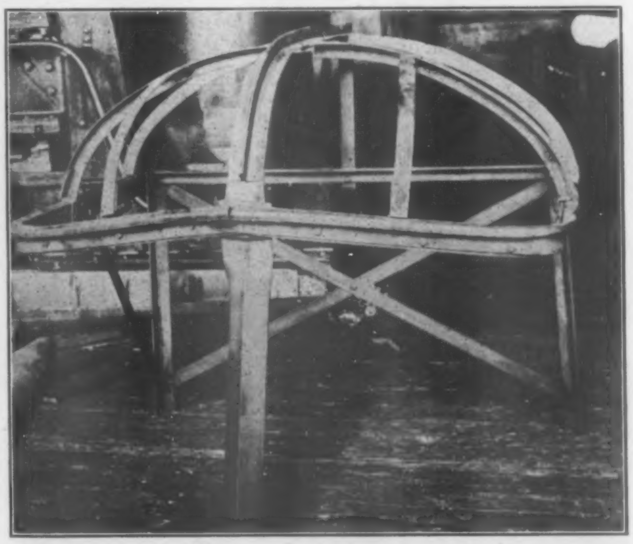
riveted together, otherwise a more or less awkward operation.

An important part of all car repairs is the maintenance of roofs which are subject not only to the corrosive action of the atmosphere, but the abrasive action of rapidly moving cinders and dirt. Hood end and

Application of new turtle-back roof end sheets

corner sheets often require renewal, and the work of forming these sheets is made relatively easy by means of the portable frame, shown in one of the illustrations. This frame is built up of angle and scrap iron, with the upper part formed to the standard contour of the hood end and supported on three legs at the proper height for convenient working. Flanges are provided, by means of which the new sheets, after shearing, can be clamped to this form while being worked into the required shape. In this way, the work can all be done accurately at the tin shop, without the necessity of making numerous trips to and from the coach shop. It will be noted that the design of this portable frame is such that any riveting required on the sheets can be readily performed, there being ample room for one man underneath to back up the rivets.

Another illustration shows the application of a complete new turtle back roof end. This end sheet is put on in two pieces and, in this particular case, the work of forming the sheets to the required contour practically all had to be done at the car itself. The sheets are riveted to the face carline and machine-screwed to the main carline. All joints are made with tar paper and Lucas cement. Parker & Kalen case-hardened sheet-metal screws, which cut their own thread, are used where the roof and end sheets connect. This joint is no longer made by electric welding as was the former practice. Extensive experience on the Rock Island has indicated that the tar paper and cement joints are both water tight and durable.



Portable frame used in forming hood end sheets and corners

Enamel for finishing coach bodies

London, Midland & Scottish applies "Vitreous" enamel to coach body of all-steel construction

THE London, Midland & Scottish Railway (England) recently placed in service an all-steel passenger train car, the body of which is finished with a vitreous enamel. This car was built for experimental purposes by the Birmingham Railway Carriage & Wagon Company, Ltd., Birmingham, Eng., and the enameling process was carried out by Mead, McLean & Co., Ltd., London. This experimental car was one of an order of 50 which were being built by the Birmingham Railway Carriage & Wagon Company, Ltd. Many difficulties were encountered in the early stages of the experimental work. It was decided at first to erect the body and attach the roof temporarily to the body structure. All the plates were drilled and prepared previous to application, due allowance being made for the thickness of the enamel coatings. However, it was difficult to apply the enamel plates without chipping the enamel, although various experiments were made with bolts, solid rivets, split rivets and, finally, drilled rivets. The latter were applied with a lead washer under the head which proved to be quite successful.

The car body was assembled for drilled fittings. On the completion of this work, the plates were taken down and sent to London for enameling. As it was difficult to ascertain how enameling would affect the drilled panels in relation to their position on the frame posts, etc., which were not enameled, it was necessary to exercise considerable care and foresight to avoid possible difficulties in the final assembling.

London Midland & Scottish Railway steel coach finished in vitreous enamel

Certain mouldings, exterior frame bolts, etc., which were originally made from mild steel, became so twisted and distorted after enameling that they had to be scrapped. New parts were made from Armco iron which withstood the enameling process satisfactorily. A

further difficulty arose due to the enameling not being entirely cleaned out of the rivet holes. Naturally, these holes would not take the rivets and had to be reamed out. Special hollow rivets with snap heads, which had not been enameled prior to riveting to match the paneling, were applied on the outside body work.

The enameling of the exterior of the car has been carried out in railway company's standard colors, including lettering and numbering. The decorative fine lining has been omitted as it was considered impracticable. No paint has been used above the underframe, except around the door margins and corridors. All the exterior paneling, mouldings, etc., used on the sides, ends and roofs, are enameled by the vitreous process. Fourteen-gage plates are used for the sides and ends and 16-gage for the roof.

The center sill is constructed of rolled-steel channels, the cross bearers and side sill angles all being riveted together. The end sills are reinforced behind the buffers

End view of the coach

to withstand severe buffer shocks. The car is mounted on four-wheel trucks of L. M. & S. standard construction. The body framing is constructed of pressed vertical members and rolled-steel longitudinal members. The running board, along which the ticket collector moves on the outside of the car, is futher strengthened by stays riveted to the side sill.

The roof is stiffened by four steel diaphragm plates, suitably spaced so as to form a rigid structure. Brass angle sections, having a copper oxidized finish, are fitted around the door check to protect the heads of the non-enameled screws.

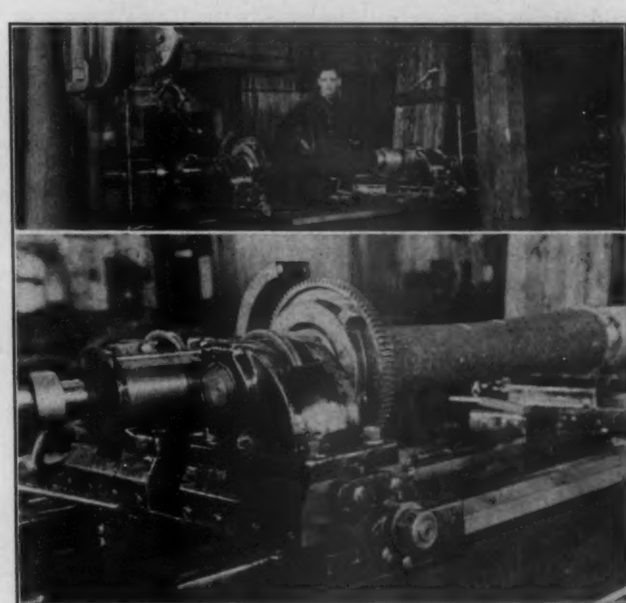
The interior of the car is of L. M. & S. standard finish, with the exception of the floor which is constructed of dovetail galvanized steel sheets, covered with a hard quality of Induroleum. The cars have electric lights, steam heat and automatic vacuum brakes.

In order to test the efficiency of the riveting as a whole, but particularly in the roof, water was played at close quarters from a fire hose over the sides and roof of the car. Few leaks were found and these were finally made water tight. It is expected that the vitreous enamel colors will be permanent and that there will be no need for repainting or revarnishing with ordinary coatings.

New Haven machine for rolling car journals

AFTER the finishing cut has been completed on a car journal, a burnishing tool is used to remove, as nearly as possible, the tool marks left by the finishing tool. The purpose of this operation is to secure on the journal surfaces a smooth, hard finish so as to prevent a hot box being caused by an imperfection on the journal rubbing against the soft metal of the journal bearing. This practice has been used with a great deal of success for years. However, W. Hurst, shop and tool specialist for the New York, New Haven & Hartford, at the Readville shops, felt that a further improvement could be made to the car journal not only by obtaining a smooth finish, but also by increasing the Rockwell hardness of the journal surface.

The machine, which was built by the Putnam Machine Works, consists of two tailstocks and two carriages mounted on a substantial bed, each carriage having a front and rear burnishing tool. Both journals of an axle are burnished at the same time. The two burnishing rolls, one at the front and one at the rear, are brought into contact with the journal by a large diameter screw operating in bronze nuts. The screw is not confined in the carriages endwise, but it is free to float. The burnishing rolls are set at a slight angle to each other and automatically feed themselves along the bed, stopping when they strike the shoulder on the axle.



Two views of the car journal burnishing machine located at the Readville (Mass.) Shop of the New York, New Haven & Hartford

This machine is used for rolling both passenger and freight car journals. Since the machine was put in operation, extensive Rockwell tests for hardness have been made on many of the journals rolled in this machine. It has been found that the hardness of the outter surface of a journal that has been in service from one to two years, averages about 38 shore. After one turning of the journal, this hardness is reduced to between 24 and 26 shore. After the first pass of the rolls over the journal, the hardness is again brought back to 32 shore. The second pass of the rolls produces a hardness ranging from 36 to 38 shore. In addition to the hardness, the finished surface is as smooth as glass.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Defect card to cover both labor and material

On March 11, 1926, the Charleston & Western Carolina applied one A. R. A. brake lever to the "A" end of a C. C. & O. coal car. On April 3, 1926, the Clinchfield secured a joint evidence card showing that the car was found with two brake levers at the "A" end with hole spacing, 22 in. by 8 in., and that the holes should have been spaced 18¾ in. by 7½ in. The Clinchfield requested a defect card for one of the wrong levers, which the C. & W. C. furnished, but for labor only. The C. & W. C. stated that it used a standard A. R. A. brake lever and as there are no standard A. R. A spacing for brake lever holes, and not knowing the Clinchfield standard, it had punched the holes to conform to the A. R. A. standard foundation brakes in order to secure the proper piston travel for this class and weight of car. Realizing that joint evidence is final, the C. & W. C. issued a defect card for one brake. lever only. The Clinchfield, after receiving the C. & W. C. defect card for labor only, rendered a bill for labor and material, according to Rules 87 and 122.

The decision of the Arbitration Committee was that "Rule 122 requires that the repairing line provide such forgings from its own stock. Therefore, Rule 88 does not apply. The defect card should be corrected to cover both labor and material, to comply with Rule 87. Decisions 1396 and 1404 are parallel."—*Case No. 1557—Charleston & Western Carolina vs. Clinchfield.*

Responsibility for cost of transferring car lading

During November and December, 1921, several loaded freight cars were received by the Pennsylvania from the Norfolk & Portsmouth Belt Line, which, acting as a switching road, was making the delivery from the Norfolk Southern. Inspection at the point of interchange developed cracked body center plates, with the result that the Pennsylvania requested the chief joint car inspector to issue a car transfer check for the transfer of lading. The chief inspector refused to issue a transfer authority on the grounds that the center plates were not cast integral with the body bolster, therefore, A.R.A. Interchange Rule No. 2 Section (f), governed this case. On May 23, 1922, the N. & P. B. L. Interchange Association instructed the chief joint car inspector to issue transfer authority for transfer of the lading from the cars in question and subsequent cases. The chief inspector complied with the instructions, under protest, and when the Pennsylvania rendered a bill on the transfer checks, the Norfolk Southern refused to pay, on the grounds set forth by the chief inspector when the original request was made. The bad center plate casting in question had a 12-in. by 13-in. re-inforcement, which projected 9 in. upward between the center sills into the body bolster and had 8½-in. by 8½-in. wings, or extensions, on the sides which rivet to the bolster. These three projections were cast integral with the center plate proper. The Norfolk Southern stated that this center plate could not be considered in the category of "a center plate cast integral with the bolster" and, therefore, not subject to transfer authority under Rule 2, Section (f), Item 4. The Pennsylvania, on the other hand, contended that the center plate was cast integral with a sufficient portion of the body bolster to make it a transferable defect.

The Arbitration Committee stated in its decision that "Rule 2, Section (f), Item 4, was not intended to apply to body center plates of the construction indicated. The bolster, standard to this car, is incomplete without the center filler which is cast integral with the center plate. The position of the Pennsylvania is sustained."—*Case No. 1558—Pennsylvania vs. Norfolk Southern.*

Credit for undamaged parts of draft gear removed

The Missouri Pacific repaired, on July 31, 1926, North American Car Corporation car No. 1411, applying springs and follower plates in place of a defective Cardwell draft gear. Credit for the defective gear removed was based on allowances in conformity with the types of gears specified in Rule 101 and, in addition thereto, a weight credit at .5 cents per pound for springs and the friction rod. The question involved in this case is what allowance should be made for the damaged parts, particularly those consisting of draft rods and springs, removed from Cardwell draft gears. The Missouri Pacific stated that prior to the application of Rule 101, establishing credits for various types of draft gears, weight credits were allowed for a complete gear removed, including springs and rods, but as a result of specified credits now established under this rule, regardless of the condition of the springs and rods, the allowance for the credits on the gears should cover whatever losses may be incurred for any differential between new, second-hand or scrap values of the springs and rods. The owner stated that the Missouri Pacific repair card showed that the springs and rods removed from the car were in good condition, yet the repairing line allowed only scrap credit for these items.

The Arbitration Committee stated that "Under the rules in effect at the date of repairs, the undamaged parts should be credited at a value new, as indicated in Decisions 1456 and 1474. For repairs made on or after January 1, 1927, the note following Item 297-B, Rule 101, will apply."—*Case No. 1559—Missouri Pacific vs. North American Car Corporation.*

Insufficient information furnished as to how car was damaged

On March 30, 1923, Mather stock car No. 664 was repaired by the Wheeling & Lake Erie, at which time, among other repairs, two metal center sills were removed and replaced and two metal side sills were straightened on the car, all account of being bent. The owner declined to accept the charge for repairs or to accept the statement furnished by the W. & L. E. as complying with the footnote of Rule 43, damage to the underframe of this car exceeding the number of underframe members therein provided for. The handling line could not, or would not tell under what circumstances the underframe was damaged, but denied that the car had been in an accident and stated that the

damage to the car was the result of a general worn out condition of the underframe.

In its decision, the Arbitration Committee stated that "The handling line has not furnished sufficient information to substantiate its contention that the combination of damage to this car occurred in fair usage. The handling line is responsible. Decisions 1219, 1283, 1302, 1344, 1382 and 1529 are parallel."—*Case No. 1560—Mather Stock Car Company vs. Wheeling & Lake Erie.*

Unfair usage claimed on account of car being telescoped

On February 1, 1927, a Pittsburgh & West Virginia train consisting of 59 loaded cars parted, moving at a speed of about eight miles an hour, which set the air brakes in emergency with the result that the N. Y., N. H. & H. car No. 80726, the thirty-sixth car in the train behind the engine, had the center sills buckled ahead of the body bolster when the impact took place. The coupler and end sills dropped down on the rails. The thirty-seventh car in the train, loaded with steel, passed over the coupler and did considerable damage to the end of the New Haven car. The New Haven stated that the fact that another car ran over its car, brought the case within the scope of Rule 32, Section (O), (telescoping superstructure above the sills due to mounting of adjacent car). The handling line stated that as there were no wheels in the train off the track and the accident was entirely due to the air going into emergency, the case came under Interpretation No. 5 of Rule 32.

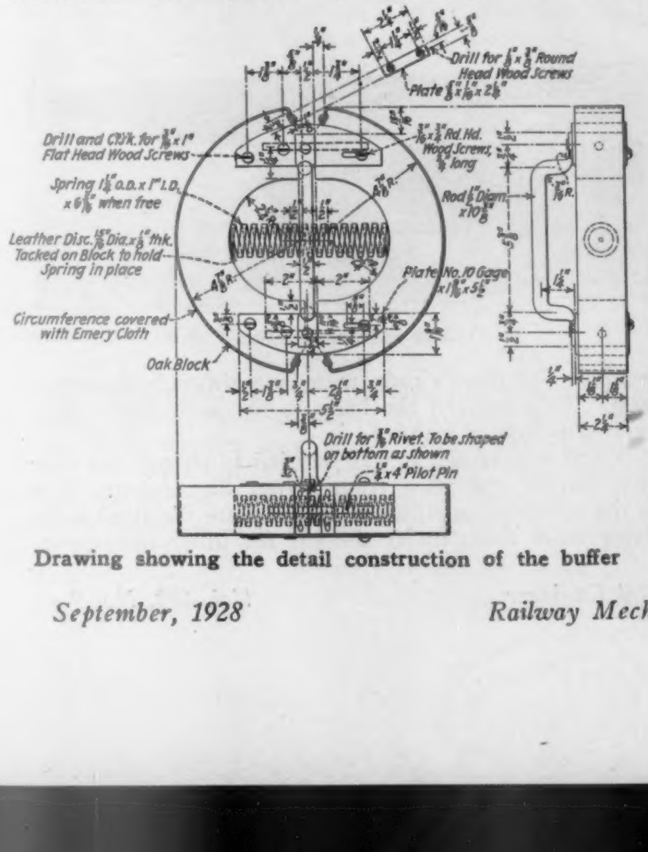
The Arbitration Committee stated that "Photographs of the damaged car show that the superstructure was not telescoped within the intent of Section (O), Rule 32. Interpretation No. 5 of the same rule applies. The owner is responsible."—*Case No. 1561—Pittsburgh & West Virginia vs. New York, New Haven & Hartford.*

Buffer for removing rust from brake cylinders

By A. F. Coulter

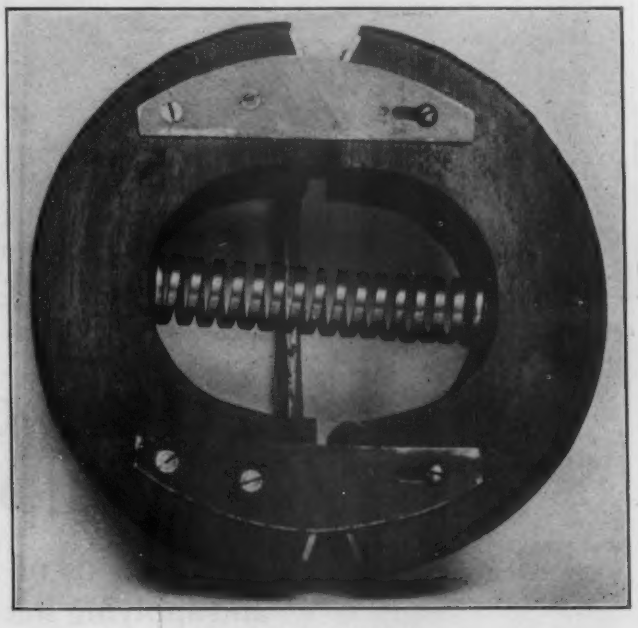
Master car builder, Union Railroad, East Pittsburgh, Pa.

An efficient device for removing rust which accumulates on the inner walls of brake cylinders is shown in the illustrations. This rust is due to two causes: Climatic conditions and defective air-brake equipment which allows moisture to enter the cylinder. If it is not removed, it will cause rapid wear to take place on the packing cup.



Drawing showing the detail construction of the buffer

It will be noted from the drawing that the buffer is made slightly over-size in diameter. Allowance, however, has been made by means of notches cut in the two No.-10-gage plates, which hold the two blocks together, to compress the buffer against the spring so that it can be placed inside the brake cylinder. The



Rear view of the buffer

outer face of the buffer, which is covered with an emery cloth of fine grain, is 2¼ in. wide. It is provided with a handle so that the air-brake repair man can move the buffer back and forth in the cylinder. The compression spring is only 1¼ in. outside diameter by 1 in. inside diameter and 6 5/16 in. long when freed. It is an easy matter for the operator to hold the two blocks together when inserting the buffer in the cylinder, but, at the same time, the spring affords sufficient pressure against the two blocks to hold the buffer faces against the cylinder wall. Only a few strokes backward and forward, the full length of the cylinder, are required to remove any rust that may have accumulated.

* * *

Oxygen and acetylene is distributed from this building for use in the D. L. & W. shops at Kingsland, N. J.

Rebuilt Monon passenger car with underframe strengthened and steel sheathing applied

Improving wooden passenger equipment*

An outline of methods of strengthening underframes and applying steel outside sheeting

By D. D. Robertson

Master mechanic, Chicago, Indianapolis & Louisville, Lafayette, Ind.

THE advent of all steel equipment in passenger service, with the rapid increase in the number of all steel mail cars and other headend equipment, and with heavy Pullman equipment, some of which was all steel, on the rear of trains, caused the Chicago, Indianapolis & Louisville to be much concerned in regard to its all wooden coaches.

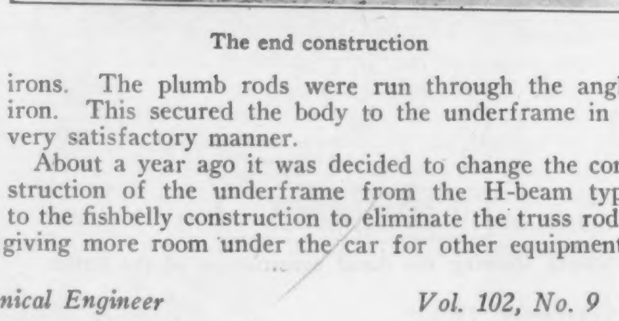
These cars had only light channel center sills and very light H-beams for platform support. With the exception of this light construction the coaches were in good condition and not very old. They had a seating capacity for 88 people, a length of 70 ft. inside of end sills, and a weight of 128,000 lb. The company owned 35 of these cars.

This question was given careful consideration from all angles and it was decided to strengthen the underframe and body of the cars in order to retain the all-wooden cars in service.

In 1918 we started to apply steel undertrames to some of these cars by using the Commonwealth cast-steel body bolster and platform end castings, and two 10-in. H-beams, 44 lb. per ft., for center sills, with an angle iron, ¾ in. by 6 in. on each side securely riveted to the steel end casting. Four cast-steel cross bearers were used to tie the frame. Two of these bearers were used for truss-rod supports.

This construction afforded a thoroughly satisfactory buffing column throughout the length of the car and by the use of four truss rods provided a foundation for the body of the car. With this construction of underframe we applied all steel trucks, equipped with clasp brake, using the Pullman built-up pedestal.

The body of the car was fitted tightly between two end castings and bolted to the center sills and angle irons. The plumb rods were run through the angle iron. This secured the body to the underframe in a very satisfactory manner.



The end construction

About a year ago it was decided to change the construction of the underframe from the H-beam type to the fishbelly construction to eliminate the truss rods, giving more room under the car for other equipment.

* Paper and discussion presented at Tulsa, Oklahoma, meeting of Southwest Master Car Builders' and Supervisors' Association, March 16 to 17, 1928.

This is the only change that we have found necessary to make in the underframe.

We also steel sheathed the outside of the car in order to stiffen the body and eliminate squeaking. The body of the car was given a rigid inspection. If a car had any defective posts or braces, they were removed. If the body of the car was found in good condition we would apply steel over the old siding, but if the siding had to be removed to make repairs to posts or braces, we then applied siding one inch thick, 5¼ in. wide, 18 or 20 ft. long, running it lengthwise of the car and lapping the ends of the boards. This was secured with screws. This construction stiffens the body of car and makes a better surface on which to apply sheet steel. We also removed the old style deck sash, closing all openings in the same manner, and the only openings were for ventilators. This stiffened the upper deck.

We use No. 12 sheet steel for sheathing the outside of the car, running the steel lengthwise of the car, and getting the sheets as long as possible. We try to use only three sheets to the side of a 70-ft. car. We use a wide batton at the connection of sheets. Then the sheets are secured with No. 18, 2½-in. round-head blue screws. Screwed into posts and bracing, this virtually acts as a very deep, but light girder. Its application in this manner prevents it from buckling owing to the fact that it is so securely fastened to the body of the car.

On the inside of the car we use the same weight of steel for lining the sides. For head lining we use No. 16, on both the upper and lower decks. This has the same advantage as the outside sheathing only to a lesser degree. The steel interior and exterior has the advantage of reducing the maintenance expense to a considerable extent.

Whenever the car in question was not equipped with modern electrical equipment, this was applied, giving the cars a fine finish and appearance similar to an all-steel car.

After running these cars eight years we found that they stood up to the service required, and are in daily service with all-steel equipment and by following out the above practice the company was able to keep their all-wooden coaches in service at a small expense in comparison with the price of new all-steel cars.

Discussion

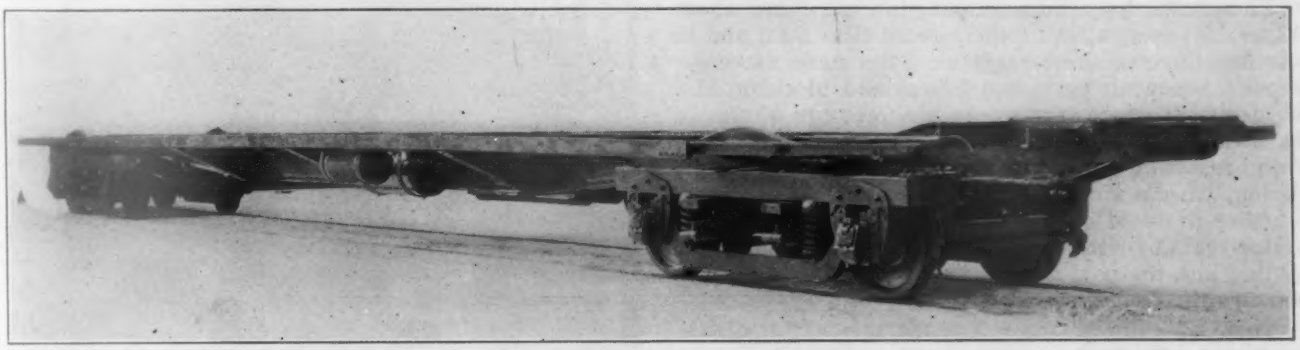
J. R. Hayden (M. K. T.): I would like to ask Mr. Robertson one or two questions. In putting the steel outside of the wooden sheathing, does that permit you to keep your cars out of the shop longer? What was the average life of the sheathing under the steel and have you had any trouble with the screws working out?

Mr. Robertson: The first car that we steel-sheathed was turned out of the shop in August, 1918. The sheathing was placed on the old siding of that car. We sand-blasted the steel before it was applied to the car. The steel was painted with Dutch Red Boy. I just inspected that car before I left the shop the other day when the car came in for repairs. The steel is in perfect condition. There isn't a loose screw visible on the car any place. During that time the car has been in on an average of possibly every sixteen or eighteen months to be cleaned up.

About a year ago we sand-blasted that particular car because we wanted to test out Duco lacquer. We applied Duco at that time and while it was in the shop the other day after fourteen months' service, we washed the car and used the Duco No. 7 polish and went over the paint and cleaned it up and it is all ready to go out, as far as the paint is concerned.

We have never had a bit of trouble under the construction as I have outlined it. Prior to 1918 the company had some cars steel-sheathed. I wasn't there at the time, but I think they were two baggage cars. They had trouble. The material that was applied to the outside was too light and they used a very narrow batton with a narrow row of screws up through the center of the batton. You can understand that the batton turned over, the weather got underneath it after it turned over, and of course, it started to rust. We saw where the mistake was made and started in on this other construction.

We were faced with the situation of having to do this on account of the great number of steel cars we were handling daily and the fact that we had high competition between Chicago and Indianapolis. We had to have as good equipment as our neighbors were running.



The underframe and truck assembly

Mr. Hayden: Practically all of the other type wooden passenger equipment we have operating on our main line trains have been reinforced in very much the same manner as Mr. Robertson described the Monon as doing. Our experience has been practically the same as his. We have had no trouble with it whatsoever.

E. H. Weigman (K. C. S.): I might say that Mr. Robertson was selected to prepare this paper on account of the very fine job we thought he was doing on the Monon in improving the older equipment on that road. Last fall I had the privilege of visiting Purdue University in connection with the A. R. A. draft gear and air brake tests and while there, several of us railway men visited the Monon shops and were shown through their coach shop and we had an opportunity to see what kind of work they were doing.

At that time they had several completed coaches

that I thought were first class jobs and it was for that reason that the Executive Committee, at my suggestion, called upon Mr. Robertson to favor us with a paper on the subject, feeling that he would give us a very good paper, and I am sure we all agree that he has fulfilled that expectation one hundred per cent.

This subject interests me particularly at this time on account of the fact that we are about to steel-sheath about twenty cars this year. The cars that we are going to treat in this manner are 70-ft. wood coaches and chair cars, built some 15 or 20 years ago, with steel underframes and all wood super-structure. We are not going to make any changes in the underframe construction and are merely going to apply the steel sheathing on the outside over the existing wood sheathing. We are going to cut out the Gothic sash and apply a wide letter board; also, we are going to cut out the ventilators and apply a modern Garland or some other suitable ventilator.

I note Mr. Robertson states in his paper that the application of steel sheathing on the outside has had a tendency to strengthen the body of the car and eliminate body squeaks. Thus far in my study of the work and what we are going to expect of the job that we are going to do, I have not felt that we are going to eliminate body squeaks in our all-wood superstructure coaches. However, if that has been the experience of the Monon we should experience the same advantage and if it does do that it is going to help our coaches considerably. We all know that it is impossible to keep out body squeaks in all-wood superstructure coaches, no matter how tight we keep them.

These cars have been running on our lines about 12 or 15 years, some of them more than that, and in the last three or four years we have made extensive repairs, renewing posts and braces and blocking, and we feel that we have a reasonably tight car where we have done this. However, we have not been successful in removing the body squeaks and I have been wondering, when we undertake our program this year, whether it would be necessary for us to go into our frame again by removing the sheeting and blocking and getting into the post and brace conditions and making some further renewals.

That, of course, entails considerable expense that must be borne by our maintenance account. The actual steel sheeting work is an A. F. E. item and does not come out of maintenance allowance. I would like to have Mr. Robertson give us an idea as to just how far we should go in tightening up the body of our cars in order to apply the steel sheathing satisfactorily and insure the screws staying in.

Mr. Robertson: In all cases where the car shows any sign of being racked at all, so it would show movement, we would remove enough of the old siding to be able to get at our plumb rods. We took out all the old plumb rods and increased their size. You must depend on anchoring your car. Of course, your car must be thoroughly blocked, and while I stated that we applied sheeting on the old siding, we have several cars that have been running a few years in that manner but the better class of our equipment has had the siding taken off. By putting the boards lengthwise and securely fastening them to the posts with screws, the car is tied up in such a manner that there is very little squeak in the car.

On our line from Chicago to Indianapolis it is level. There is some curvature and we run the trains at a fairly high rate of speed. I have ridden these cars going in on the night train when the train was making a mile a minute and I couldn't hear a bit of disturbance in the car. In fact, I felt the day coaches in that train were giving a better performance than the Pullman cars behind them which were partly wooden construction.

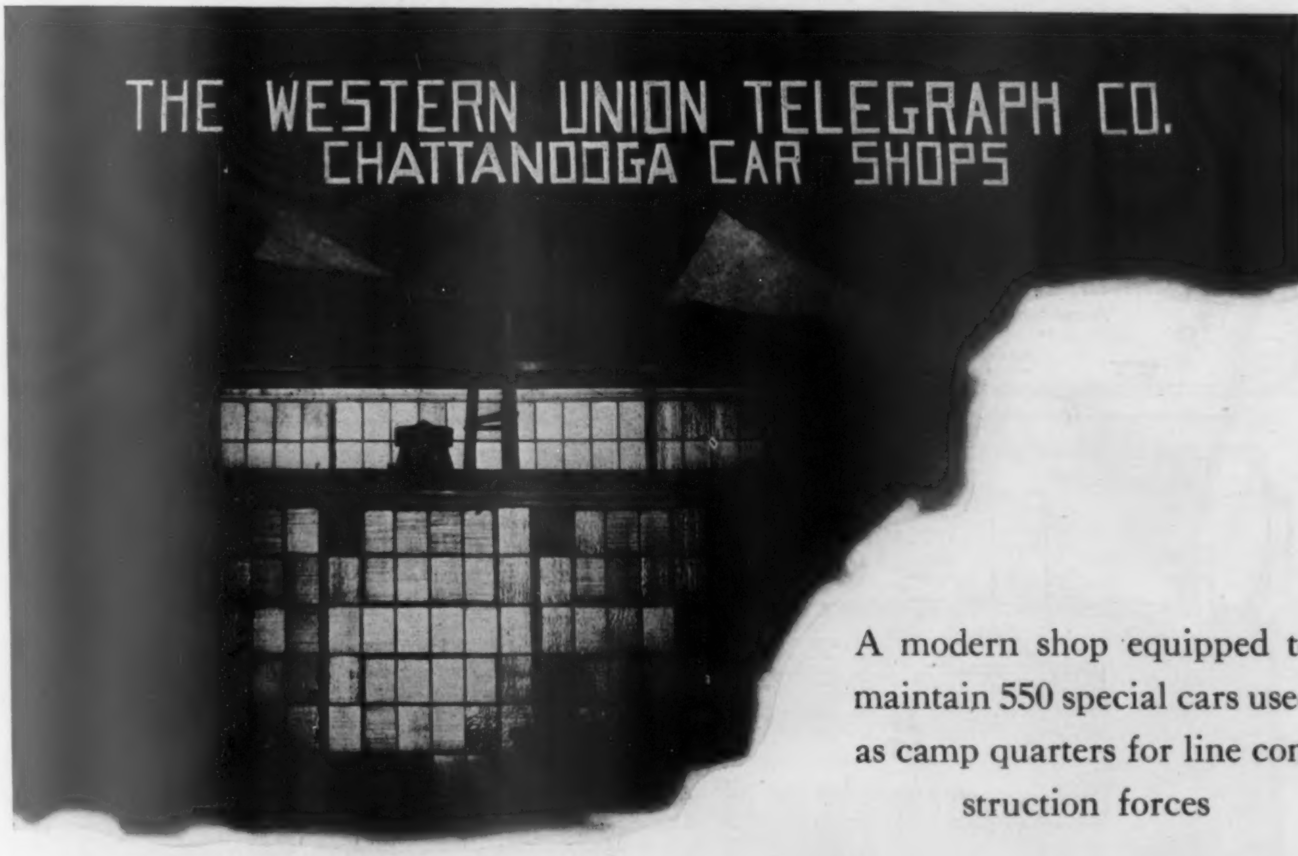
On the southern end of the line, going to Louisville, there are some pretty good grades and the cars get racked a good deal.

In my opinion you must not try to steel-sheath your car unless you stiffen up your plumb rods and be sure that the body of the car is thoroughly anchored, because that is what stays your car. When we want extra protection, which we think is very good, when we resheath a car with the application of steel, after the sheathing is thoroughly secured, we put two coats of Lucas roof cement on the wood. We let that thoroughly dry. That, in our opinion, preserves the wood.

Interior view showing the attractive appearance and excellent lighting facilities

We do away with the nosing under the windows of the car. I never knew what that was for. I thought it was just extra wood, but by welding the angle iron that goes on there, we have no joints, that angle goes the full length of the car and fits in around the window sill and makes it absolutely tight. To avoid the possibility of that welding breaking we lay a piece of copper under that before it is applied and we have had much success in following that practice.

I want to say that our people, especially in the passenger department keep after us very closely and we have to have cars in very good condition at all times. There are the Big Four and the Pennsylvania running between Indianapolis and Chicago and, as I said, competition is very keen and the way the cars look and ride is taken into consideration. We don't want to lose a dollar, of course, so we try to have the equipment in first class shape.



A modern shop equipped to maintain 550 special cars used as camp quarters for line construction forces

IN ORDER properly to maintain the equipment which operates over the entire United States, the Western Union Telegraph Company has erected a modern, well-equipped car repair shop at Chattanooga, Tenn. The primary purpose of this shop is to make general repairs to about 550 cars of special types which are used as living quarters and work shops by the telegraph line construction and reconstruction crews. The construction and maintenance work of the Western Union is organized into nine divisions with headquarters in the following cities: San Francisco, Cal.; Denver, Colo.; Omaha, Neb.; Dallas, Tex.; Atlanta, Ga.; Chicago; Cleveland, Ohio; New York, and Boston, Mass. The camp car units are made up of four cars, known as an "outfit," consisting of a sleeping car, dining car, tool car and water car. A four-car outfit accommodates a gang of 16 workmen, one foreman, one cook and one cook's helper. Occasionally it is necessary to make up gangs of 20 or 24 men, in which case another sleeping car is added to the outfit.

Description of equipment

The majority of the sleeping and dining cars are old wood Pullman cars or cars of a similar type; the tool cars are 50-ft. box or baggage type, and the water tank cars are standard tank cars of 7,000 to 10,000 gal. capacity.

The sleeping cars are 77 ft. 10 in. over the faces of the couplers and have vestibules and diaphragms at both ends. The dining cars are 72 ft. 2 in. over the faces of the couplers and are of similar design. Originally these coach cars were entirely of wood construction, including the underframe, but quite recently the company has started to equip these long cars with steel underframes at the general shopping period. The tool cars are 52 ft. 6 in. over the faces of the couplers and are of wood construction with steel underframes. All four cars making up the outfit are permanently coupled together when in service, and the end of the tool car, which is coupled to the kitchen end of the dining car, is built with the floor level raised to that of the dining car and is equipped with a diaphragm. The order of coupling the four-car unit is as follows: The sleeping car, the dining and kitchen car, the tool car, and the tank car.

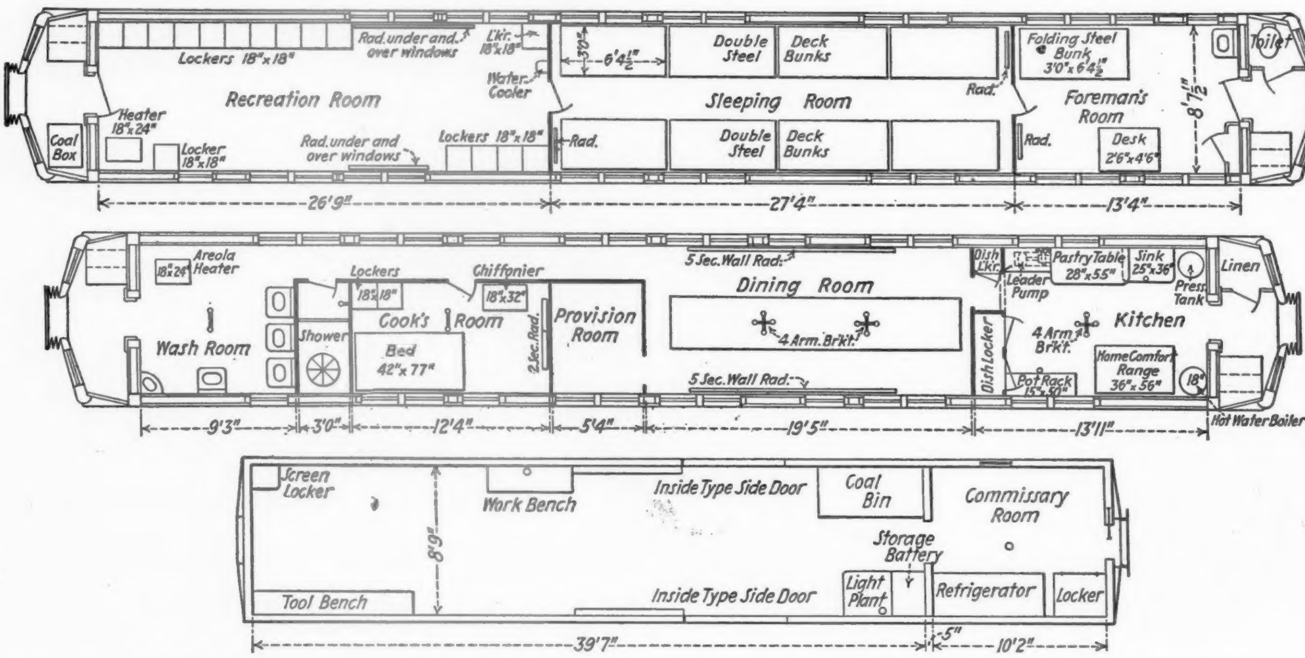
One of the illustrations shows the floor plans of three of the cars. The sleeping car is divided into three sections—recreation room, sleeping room and the private quarters for the foreman. The dining cars are divided into four sections—the wash room, private cook's quarters, dining room and kitchen. The cooking for a gang is usually handled by a man and wife, and the cook's quarters are fitted out as private living quarters, separate from the rest of the car. A commissary room is located at the end of the tool car that is coupled to the kitchen end of the dining car. The rest of the tool car is used for the storage of equipment used in the work and as a work shop. Adjacent to the commissary room bulkhead is located the portable lighting plant which furnishes the current for lighting the entire outfit, for running the kitchen exhaust fans and for operating a pump which maintains a pressure of from 30 to 40 lb. on the drinking and washing water system. The lighting plant consists of a gasoline engine-driven generator set of the 32-volt type, having a storage battery set made up of 16 cells of 240 amp. hr. capacity. The generator sets are either of the single-cylinder or four-cylinder engine type.

The coach cars are equipped with the old type Pull-

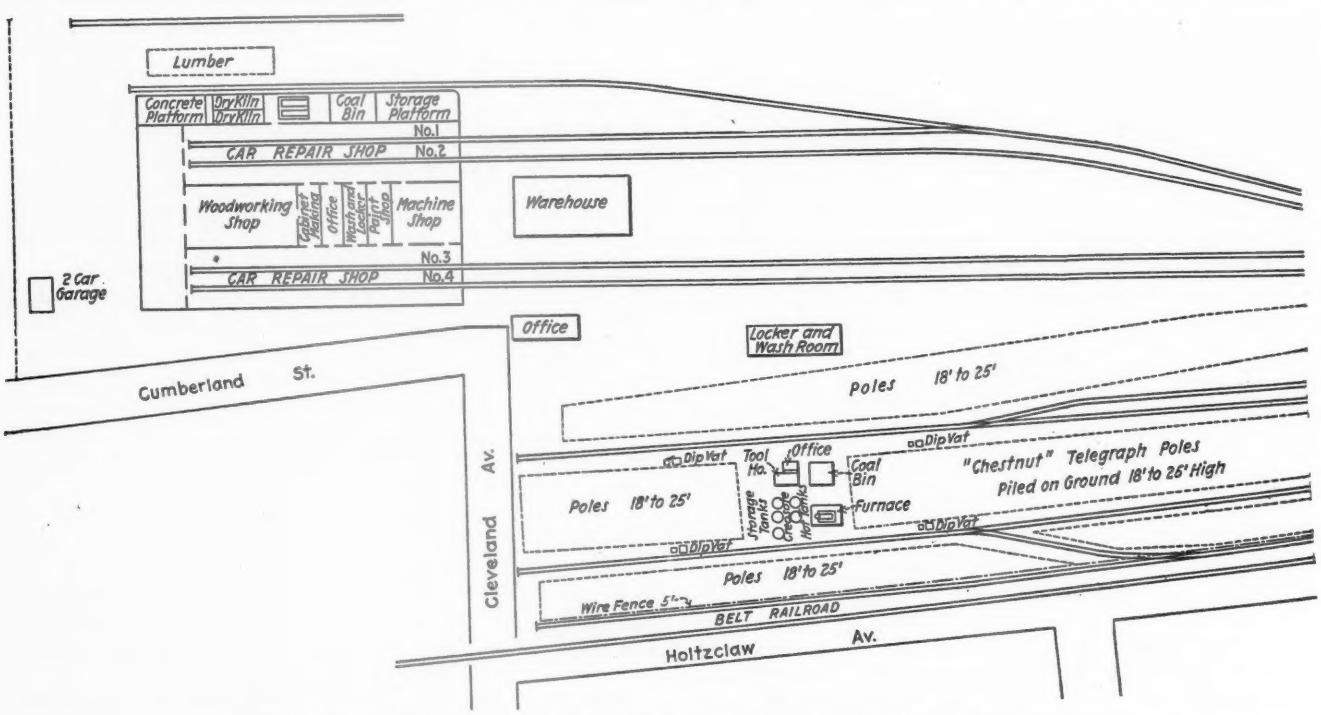
man six-wheel trucks and the other cars are equipped with four-wheel trucks. All of the cars have brake equipment suitable for operation in passenger service.

The shop facilities

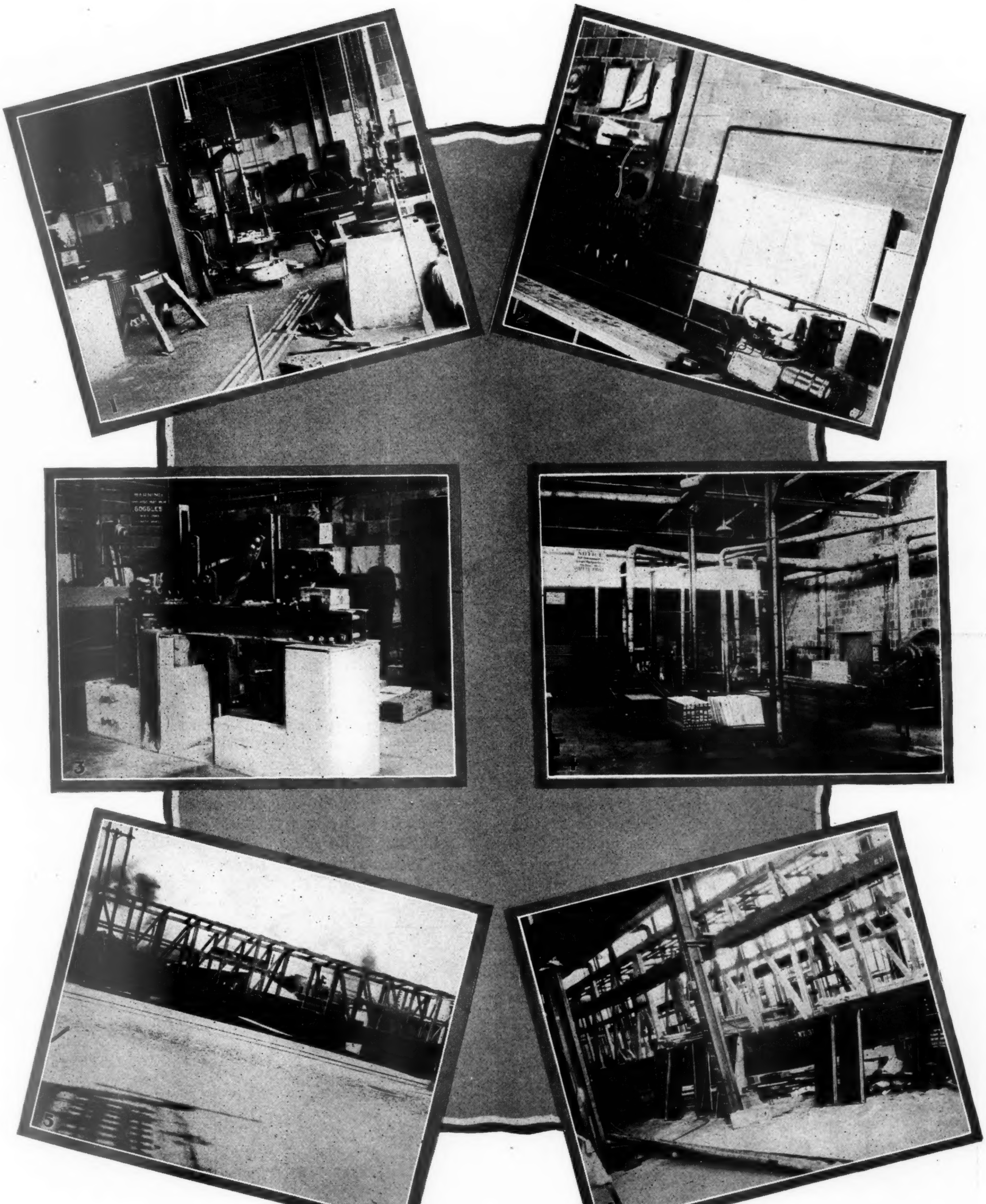
The main shop building is a steel and hollow-tile structure, 157 ft. in width by 237 ft. in length, divided into three bays, the two outside bays being the car repair sections, each having two working tracks, making four working tracks in all. Each track is of sufficient length to provide working space for an entire four-car outfit. In the middle section of the shop is located the woodworking shop, the cabinet shop, the general foreman's office, the wash and locker room, the sash and door paint shop and the machine and blacksmith shop. The center section is isolated from the car repair sections on either side by fire walls, and the paint shop is likewise isolated from the rest of the shop. The shop is of dead-end construction, the work being of such character that a through-track shop would be of no advantage. At the south end of the shop and extending across the entire width is the storehouse, 35 ft. by 157 ft. Along the west side of the shop is located the boiler house, coal storage, a 25,000 board-foot capacity dry kiln and two concrete storage platforms, 25 ft. wide. The shop building has a saw tooth type roof and is designed to provide a maximum of natural lighting. The building is equipped with an indirect



Floor plans of the sleeping car, dining car and tool car of the camp outfit—In addition there is a water tank car



Layout of the Chattanooga car shops of the Western Union Telegraph Company

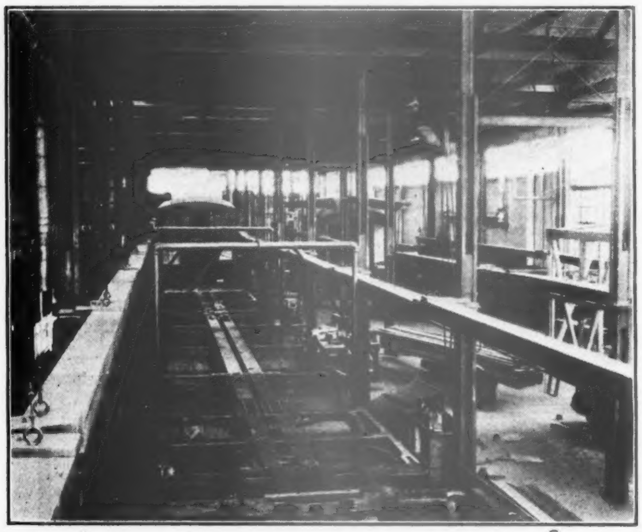


1—The machine and blacksmith shop—An electric driven compressor furnishes air for the entire plant 2—Complete testing equipment is provided for testing portable lighting sets and for charging batteries—One of the four-cylinder generator sets in the foreground 3—An excellent example of a home-made pneumatic punch, shear, and bending machine designed for special work 4—A corner of the wood mill—The type of equipment in service necessitates modern woodworking facilities 5—One of the 50-ft. steel underframe tool cars after the framing has been completed 6—The 50-ft. tool car ready for the sheathing, siding and roof

heating system which maintains the interior temperature at a point between 60 and 70 deg. F. in the coldest weather, and during the summer months the system is used for ventilating and cooling the shop.

This feature contributes materially to the increased productivity of the workmen during the extreme heat of the summer months.

In addition to the regular car repair work the Chattanooga shop handles quite a volume of special work,



Looking down on one of the steel underframes for the sleeping car which is made up of steel castings and H-section center sills

principally of cabinet variety, on equipment used in the various offices of the company.

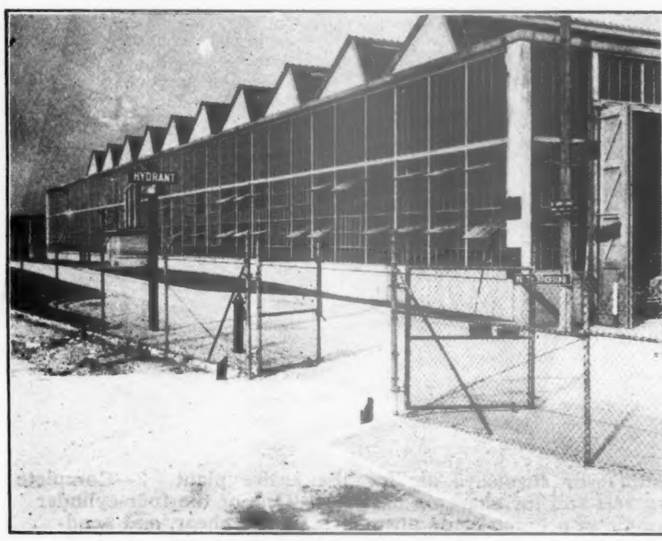
There is also located at the Chattanooga works an extensive pole storage and treating plant which, while not within the scope of this article, is of indirect interest because of the recent erection of an experimental timber treating plant designed primarily for the treatment of telegraph poles, although the process has been extended, experimentally, to the treatment of car timbers, particularly siding. Several years ago the Western Union began a research for the purpose of developing new wood preservatives and as a result of the work, Dr. L. P. Curtin, chemist of the Western Union, developed what is known as the Zinc-Meta-Arsenite process of wood preservation. The experimental plant at Chattanooga was erected and is owned and operated exclusively by Western Union, while the Curtin-Howe Corporation, New York, has been organized for the commercial extension of the process. Laboratory and field tests of treated timbers set in the ground covering a period of several years have proven highly satisfactory, and the telegraph company is now making a large number of its line replacements with zinc-meta-arsenite treated poles. Due to the fact that the treatment of car timbers by this process is yet in the initial stages, it is not possible, at this time, to give any detailed information concerning results.

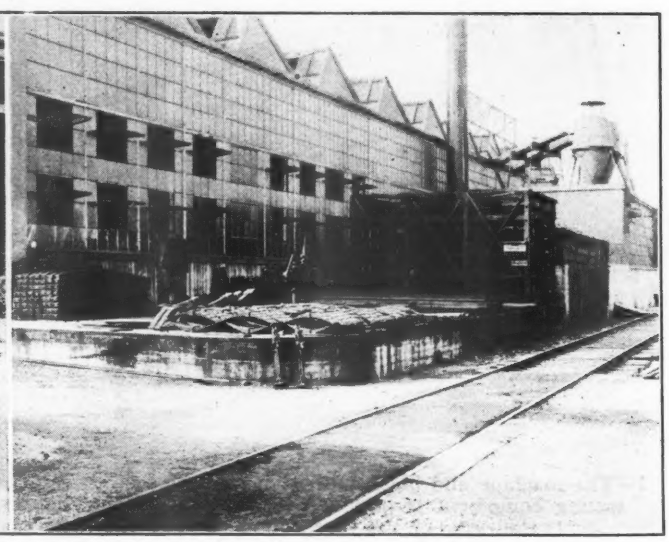
The limited adaptation of treated lumber to car work has been due to the limited capacity of the experimental plant. A commercial plant will shortly take care of all requirements. One of the illustrations shows a complete camp car outfit. Of the cars shown, Nos. 1307 and 2308 have treated poplar siding and No. 3530 has treated pine siding.

Organization

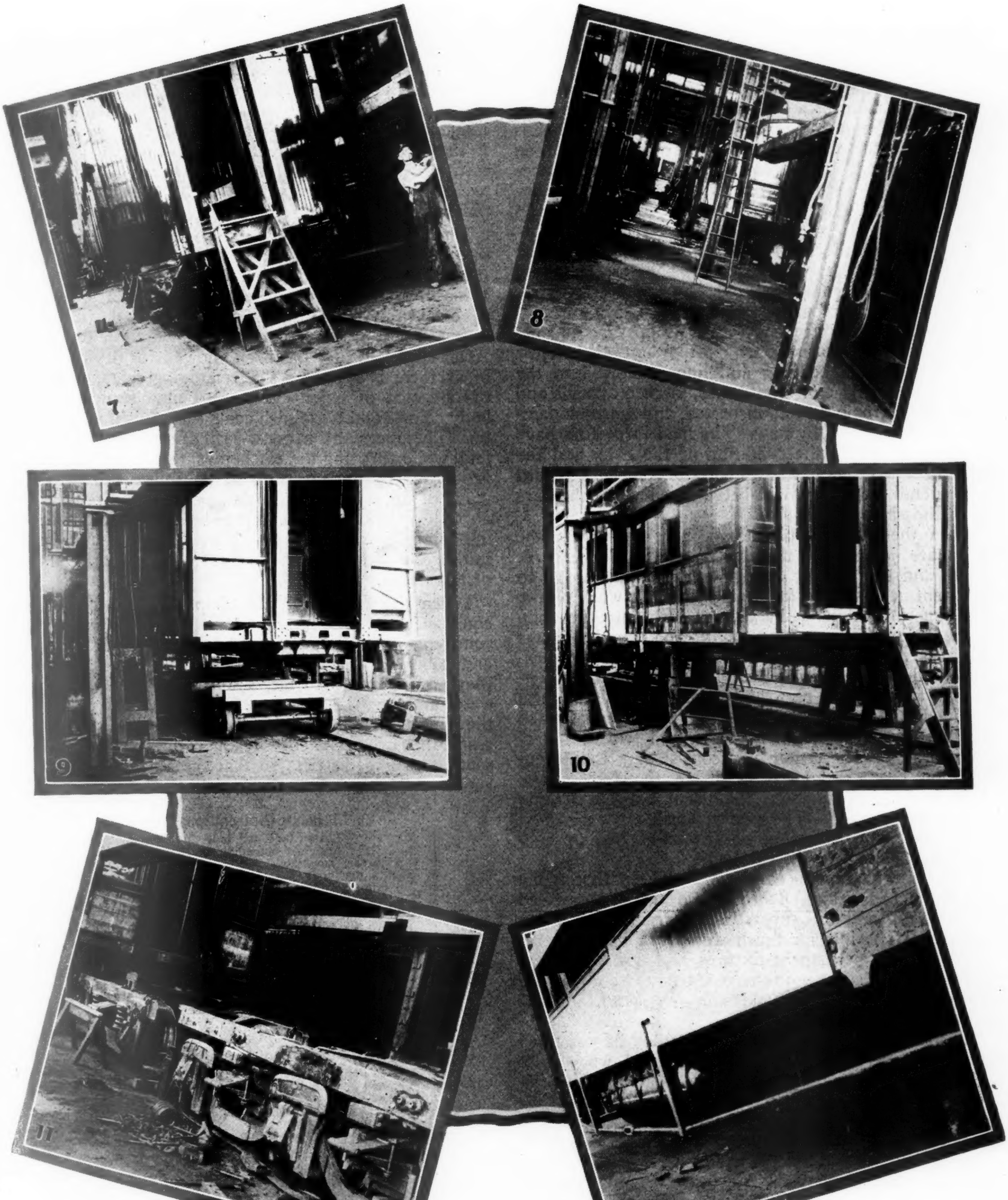
The entire organization which maintains the camp car equipment, both at Chattanooga Shop and in the field, comes under the supervision of the superintendent of the Chattanooga works. This includes the storehouse forces and, while a separate unit, the forces in the pole storage and creosoting yard. The total force, including supervisors, is about 190 men, of which 135 are assigned to the car repair shop. In addition to the work done in the shop at the general overhauling periods, the cars are given periodical field inspection and repairs. The field repairs are performed by forces taken from the car shop during the summer months and usually consist of light repairs and revarnishing. In general, the necessity for shopping the outfits is determined by the field inspectors. The field repair forces make light repairs to about 160 cars a year.

With a practically constant quantity of equipment to overhaul, plus the fact that the service demanded from it is of such a nature as not to produce much mileage, it may be seen that the problem of maintaining these cars differs somewhat from that of maintaining similar





Left—The east side of the car repair shop Fireproof construction and maximum window area provide a comfortable, well-lighted building; Right—The west side of the shop showing the storage platform and the boiler plant, just beyond which is the dry kiln



7—One of the diners on which all exterior finishing work has been completed—The final finish is varnish, sprayed on 8—Looking down the shop between tracks Nos. 3 and 4 showing adjustable scaffolding, aisleway and work benches 9—Jacking up the steel underframe into place—The draft sill construction is clearly shown 10—One of the diners just after the new steel underframe has been bolted up in place and before the sheathing and siding have been finished 11—Six-wheel trucks removed, disassembled and ready for a complete overhauling 12—Two water tanks of 450 gal. capacity each are slung beneath the cars, insulated with felt, and covered with a metal sheathing

equipment in regular railroad service. The total equipment comprises about 125 outfits—some five-car outfits and extra material cars bringing the car total up to about 550. As a general practice, each outfit comes into Chattanooga shop for a general overhauling on an average of about each three years. On this basis, the shop is scheduled to turn out an average of 40 outfits, or an average of about 180 cars a year. The out-of-service time at the shop for repairs averages four to five weeks. Between general shoppings, the cars receive light repairs by the field forces.

The work of the shop is organized on a day-work basis and the cars are placed on the shop tracks where they remain until completed, except for movements required during the repair operations.

When the cars are received at the shop yard and before being taken into the shop, they are thoroughly fumigated and all bedding and linen removed to the renovating department. The dishes, kitchen utensils and tableware are removed and inspected, and worn or damaged pieces replaced by new. The field inspectors have sent in a report on the condition of the cars, and the shop inspectors check these reports and make a record of the detail work that will be required while the cars are in the shop.

When the cars are placed on the shop tracks, the bodies are jacked up, the trucks and draft gear removed, and the interior fittings completely removed to the extent necessary to facilitate the repair work on the superstructure. All of the cars coming into the shop at the present time arrive with wood underframes which, as previously mentioned, are replaced by steel. These underframes are of the type used for strengthening old type postal cars and consist of a cast steel combined platform and double body bolster at each end, two cast steel cross-tie beams, and two cast steel needle beams. The center sills consist of a Bethlehem H-section beam weighing 55 lb. to the foot. The whole is fabricated, using the usual truss rods, the joints being riveted. The underframes are fabricated outside the shop, rolled in on trucks, jacked up into place, and secured to the car body.

In the meantime, the car body has been thoroughly gone over, bad siding, flooring, and timbers removed and replaced, and the superstructure reinforced when necessary. The interior finish woodwork has been renewed and the permanent fixtures replaced. Window sash and doors have been removed, repaired and painted separately; the sheathing and siding replaced, and the roof repaired or renewed.

The trucks are rolled out from under the cars and completely overhauled. The brasses and wheels are replaced where necessary. The small amount of wheelage which these cars accumulate makes extensive replacements of wheels unnecessary. The shop is not equipped for wheel work, the small volume of this work required being handled by arrangement with one of the local railroad shops. The brake rigging and air equipment is repaired and replaced. The draft gear is overhauled and replaced. The air and water tanks are tested and replaced or removed. A complete testing outfit has been installed in the shop for testing the portable lighting plants and for recharging the storage batteries.

After the carpenter work has been completed on the car body and the underframe has been bolted into place, the car is lowered onto the trucks, the water and air tanks mounted, brake rigging assembled, pipe work completed, and the electrical wiring and fixtures replaced. The hot water heating equipment is installed, the toilet and washroom fixtures replaced, and, in the sleeping cars, the lockers and bunks installed. In the dining car, the wash room and shower bath fixtures are installed, the dining compartment furniture and lighting fixtures replaced, and the kitchen equipment, such as range, sink, utensil racks and water heater, installed. In the tool car, the lockers, work bench and work equipment are installed. The commissary room is fitted up with lockers and refrigerator, and the electric lighting plant is put in and tested.

The coach cars are painted and varnished inside as the work progresses, and the exterior is finished immediately upon completion of the carpenter work. Where old siding remains, the paint is burnt off, where necessary, and the entire surface sanded down for the first coat of primer, which is applied with the brush. After sufficient time has been allowed for drying, a coat of surfacer is applied. The remaining coats, consisting of one coat of color—Western Union standard green body color—and two finish coats of varnish, are sprayed on. The doors and window sash are finished separately and, while spraying the car bodies, the window openings are closed by the insertion of two-piece sliding fillers, made of tin, which fit into the openings and prevent the varnish or paint from reaching the interior. The lettering on all the cars is applied by means of stencils, except in this case, that the color is applied with a spray instead of a brush.

When the cars leave the shop they are completely equipped for three years' service and go out with a complete standard amount of linen, dishes, kitchen ware and table equipment. Before leaving the shop yard, they are given a final inspection to make sure that air, water and electrical systems function properly and that they meet all of the requirements of the service for which they are prepared. The new outfits, as a rule, are sent to remote districts so that others may be worked back toward the shop as they need overhauling.

Machine tool equipment

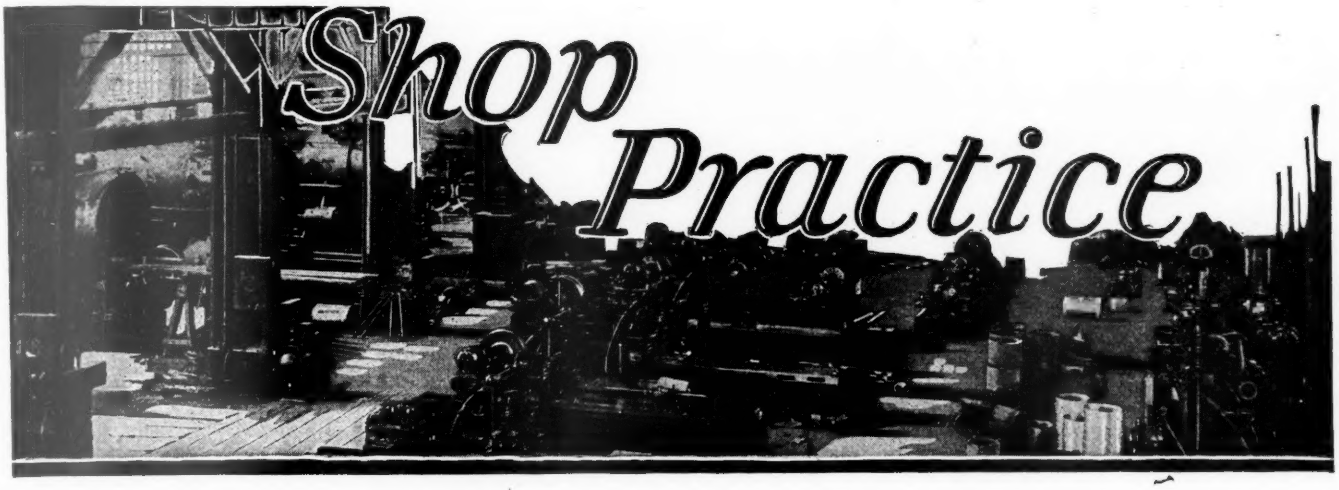
1 No. 4 B Williams pipe and bolt threading machine
1 Oster pipe and bolt threading machine
1 Tin burring machine
2 Edging machines
1 Tin crimper
1 Tin folding machine
1 Greaves-Klusman 16-in. by 6-ft. engine lathe
1 Superior upright drill, 2-hp. motor
1 Pedric, type B, pipe bending machine
1 Brake
1 Peck, Stow & Wilcox shear
1 Peck, Stow & Wilcox strip roll forming machine
1 Peck, Stow & Wilcox circular ring shear
1 Forge
1 Duplex adjustable bending machine
1 Anvil
1 Emery grinder

Tool room

1 Fay & Egan automatic knife grinder
1 Fay & Egan combination band saw filer
1 Vulcan saw brazer
1 Fay & Egan saw sharpener
1 Fay & Egan saw stretcher
1 Fay & Egan brazing clamp
1 Patch machine
1 Band saw filing vise
1 Shearer band saw
1 Foley saw filer
1 Plain knife balancer
1 Emery grinder
1 Band saw filing clamp
1 Taylor rotary gluing machine, eight clamps for each section

Woodworking shop

1 Planer and matcher
1 Rip saw
1 Band saw
1 Fay & Egan planer
1 Fay & Egan moulding machine
1 Fay & Egan mortiser
1 Fay & Egan band rip saw
1 Fay & Egan cut-off saw
1 Tenoner
1 Planer and jointer
1 Belt sander
1 Drum sander
1 Triple drum sander
1 Scroll saw



Blacksmith foremen discuss problems

Chicago convention focuses attention on the subjects of autogenous welding, heat treatment, spring making, reclamation, etc.

The International Railroad Master Blacksmiths' Association held its thirty-third annual convention at the Hotel Sherman, August 21 to 23, inclusive. At the opening session, interesting and encouraging letters were read from L. A. Downs, president of the Illinois Central, and R. M. Brown, superintendent of motive power of the New York Central, both of whom emphasized the necessity for efficiency in the blacksmith shop, and the potential value of the Master Blacksmiths' Association in promoting this end. C. W. Cross, supervisor of apprentices of the New York Central then presented a paper outlining the objectives of apprentice training as developed on the New York Central with particular reference to blacksmith shop work. Mr. Cross illustrated how the door of opportunity is open to all worthy boys by citing the case of J. J. Bernet, who started as a blacksmith apprentice and rose through the ranks to the position of vice-president of the New York Central, then president of the Nickel Plate, and now president of the Erie. E. L. Woodward, western editor of the *Railway Mechanical Engineer* discussed the subject, "The Blacksmith Foreman's Broader Viewpoint".

The following committee reports were presented: "Autogenous Welding and Cutting", by P. T. Lavinder (N. & W.) Roanoke, Va., S. Lewis (C. N.) Winnipeg, Can., and W. J. Wiggin (B. & M.) Lowell, Mass; "Heat Treatment of Steel", by W. C. Scofield (I. C.) Chicago, Ill., and H. W. Loughridge (P. & L. E.) McKee's Rocks, Pa.; "Drop and Machine Forging", by George Grady (C. &. N. W.) Chicago, F. F. Hayes (I. C.) Memphis, Tenn., and J. Carruthers (D. M. & N.) Procter, Minn.; "Spring Making and Repairing", by George Fraser (A. T. & S. F.) Topeka, Kans., E. N. Turner (A. C. L.) Rocky Mount, N. C., and C. A. Slenker (L. I.) New York; "Reclamation", by Harry Wright (P. M.) Grand Rapids, Mich., J. B. Ray (M.P.) North Little Rock, Ark., and C. Feeney (D. L. &. W.) Scranton, Pa.; "Safety First", by J. H. Chancy (C. of G.) Augusta, Ga., P. T. Curley (I. C.) E. St. Louis, Ill., and C. Feeney (D. L. & W.), Scranton, Pa.

After the discussion of the committee reports on the


W. W. Shackford (A.C.L.)
President


J. J. Haggerty (N.Y.C.)
First Vice-President


J. P. Reid (Mo. Pac.)
Second Vice-President


W. J. Mayer (Michigan Central)
Secretary-Treasurer

last day, the following officers were elected for the insuing year: President, J. Haggerty (N. Y. C.) West Albany, N. Y., first vice-president, J. P. Reid (M. P.) Kansas City, Mo., and second vice-president, R. F. Scott (Reading) Reading, Pa. Wm. J. Mayer (M. C.) Detroit, Mich., was re-elected secretary-treasurer.

The blacksmith foreman's broader viewpoint

By E. L. Woodward
Western editor, Railway Mechanical Engineer, Chicago

A substantially smaller number of men are employed in the average railway blacksmith shop now than 10 years ago. Owing to changes in conditions of various kinds, blacksmith forces have been practically wiped out at certain points and greatly reduced at many if not most others. The indications are that 25 per cent would be a conservative estimate of the average reduction during the period mentioned.

The causes for this reduction are not hard to find. In the past decade, the rapid spread of autogenous cutting and welding operations has revolutionized repair shop practice, economies being effected in most cases by the curtailment of work formerly done in the blacksmith shop. The necessity for the large blacksmith shop forces formerly employed is also obviated by the increasing use of steel castings; by the installation of modern forging machinery, usually centralized at one or two system shops; and by locally developed labor-saving devices and improved shop methods.

With a gradually diminishing force and volume of work, the average railroad master blacksmith is faced with two alternatives. He can drift with the tide, taking things easy and accepting his somewhat lessened responsibility and prestige as unavoidable, or he can, figuratively speaking, tighten his belt and determine by special study and effort to fit himself for solving new problems and meeting new responsibilities. The blacksmith shop is, and apparently always will be, a vital factor in locomotive and car repair operations, and never before was there greater opportunity for improvement and increased efficiency in this department.

Foremen with broad viewpoint needed

Constantly changing conditions require a master blacksmith with a broad viewpoint, who is alert to analyze these conditions, anticipate trends in development and manage his department in the best interests of the railroad as a whole. Such a man is an extremely valuable asset to any road, and, conversely, it is much to be doubted if any road, or the blacksmith's craft itself, has any greater single handicap than blacksmith foremen, who live in the past, obstinately refuse to see merit in new practices and believe that an operation formerly done in a certain way should always be done in the same way.

The International Railroad Master Blacksmiths' Association includes among its membership some able craftsmen, organizers, and business men, who operate their shops on an efficient, business-like basis, reflecting much credit on themselves and the railways they serve. Why cannot the example of these men be generally followed and thus make it impossible for any one to say that any blacksmith foreman is not sufficiently progressive and receptive to new ideas. This comment is now occasionally heard and some blacksmith foremen themselves admit that a certain amount of justification for the criticism exists. They say this was demonstrated by what happened when autogenous cutting and welding was first introduced a few years ago. Welding is primarily a blacksmith operation, but blacksmith foremen of the old school generally looked on the new method as little better than a soldering operation and failed to give it their real serious consideration. The machine, boiler and erecting department foreman, on the other hand recognized the possibility of using the new method to make their work easier. They experimented until they found out what could be done, and how to do it, and as a result, not only is this work taken out of the blacksmith shop but the welding operators in most cases report direct to other than blacksmith foremen.

Numberless opportunities present themselves to the ambitious blacksmith foreman to broaden his knowledge in the various branches of blacksmith work and thus fit himself to meet any contingency. Take the field of machine forging for example. Better quality forgings and higher production are the great need. Machines have been developed, which, with the proper die equipment, will turn out the kind of work wanted. It is distinctly up to the blacksmith foreman, not only to find out which of these machines is best suited to his local requirements, but to convince his superiors that his judgment is right. He must determine the cost of production, and secure other information needed in settling that difficult question of which forgings should be made locally and which bought on the open market, such factors as die cost, labor cost, overhead expense, quantity desired, accessibility to a reliable source of supply and numerous other items, all receiving due consideration. It cannot be questioned that the railroads are now using considerable locally manufactured forgings and material, which it would be better to buy, and probably the reverse is equally true. The loyal blacksmith shop foreman will discover the facts in these cases and in arriving at a decision, in each case subordinate every interest to that of the railroad he serves.

Does your reclamation work pay?

Considerable reclamation work is done in railway blacksmith shops, and more or less the same principles obtain here. The question of relative costs is vital, but the question of how much effective service can be obtained from the material reclaimed is usually even more important. Apparently there is an over enthusiasm on this subject of reclamation to judge by the following quotation from a letter recently received at our office: "Some of these fellows at the Blacksmiths' convention run wild on this subject. To listen to them talk one might think that with the proper kind of reclamation plant, run under the free-hand of the blacksmith foremen, a railroad company would never have to buy any new materials, and that reclaimed materials are superior to new materials in many ways." The elimination of waste is of the utmost importance in all railroad departments, including the blacksmith shop, and reclamation work is therefore amply justified, but only when the required standards of quality and production are maintained and accurate cost records indicate an adequate margin between "reclaimed" and "new" cost. It cannot be emphasized too strongly that the modern blacksmith foreman must be a good business man with at least a working knowledge of modern cost accounting practices and methods.

In the field of blacksmith shop machinery, tools and labor-saving devices, the average foreman feels right at home. This field is constantly growing, however, and the foreman's opportunity is to make sure that he is taking advantage of the latest developments, and not

continuing practices proven uneconomical on other roads, and at other shop points. If this association could serve as a clearing house for information regarding these practices it would be an invaluable service to the craft. It would also be very helpful if more information could be developed regarding the proper methods of making and repairing springs, now costing the railroads so much on account of difficult performance.

In connection with shop devices, the greatest care should be taken to assure the discontinuance of shop made, air-operated devices, which are demonstrably, inefficient and ineffective. To quote from a recent editorial in the *Railway Mechanical Engineer:*

"It seems to be a trait of human nature to mount a hobby and then proceed to ride it to death. The contriving and building of devices operated by compressed air, is a hobby that a great many mechanical department foremen persist in riding to the limit. Undoubtedly, the car department is more guilty of this offence, and with more excuse, than the locomotive department. Yet, the latter is not entirely innocent. A surprisingly large number of home-made air-operated tools and facilities, such as hoists, presses, formers and the like, can be found in practically any car repair shop. The most surprising part of this situation is that a large proportion of the jobs done on many of these devices can be done more economically and faster on any one of many manufactured facilities that have been especially designed and thoroughly developed for just such work.

"A number of instances can be cited where additional air compressors have been installed in shop power plants to meet the additional load which has been created largely by the increased use of inefficient shop-made, air-operated equipment. An air compressor having an output of 2,000 ft. per min. costs approximately from $16,000 to $20,000. Furthermore, it costs something to operate such a compressor. For example, if it requires 22 b.hp. to deliver 100 cu. ft. of free air per minute at 90-lb. pressure and the engine which operates the compressor requires 30 lb. of steam per horsepower-hour, and the boiler evaporates 7 lb. of water per pound of coal, with coal at three dollars a ton, the coal cost per 100 cu. ft. of free air is 0.22 cents. One large car blacksmith shop uses a homemade, air-operated press for straightening the sheets for steel cars. The piston for this press operates in a cylinder 30 in. in diameter by 18 in. long. The piston serves as a ram, to the lower end of which is secured a cast iron block, 7 in. by 15 in. by 12 in., which weighs approximately 325 lb. This is operated almost continuously and makes an average of one stroke per minute. At that rate, the press consumes 7.38 cu. ft. of compressed air, or 52.5 cu. ft. of free air per min. at 90 lb. gage and with the compressor operating at a ratio of 7.12. Using the figure of 0.22 per 100 cu. ft. this press will consume 25,200 cu. ft. of free air per day at a cost of $5.55 for coal alone.

"This, keep in mind, does not include maintenance of pipe, hose lines, etc., nor does it make any allowance for leakage. With a pressure of 90 lb. gage, a hole only 1/16 in. in diameter will allow the escape of 380 cu. ft. of free air per hour. A single hole of that size will waste $14.70 worth of coal during a month of 22 working days. It does not require many deficiencies in the equipment, such as having the cylinder too large for the job, a leaky piston, the wrong size of piping, etc., to multiply the theoretical cost of operation many times." All shop-made, air-operated devices are not inefficient, but the time required to check the consumption of many of those now in use would be time well spent.

Heat treatment presents greatest opportunity

In the field of the heat treatment of steel the blacksmith foreman has perhaps the finest opportunity to increase his knowledge, prestige and general value to the company employing him. True, the proper material must be furnished from the steel mills, but unless this steel is handled correctly in forging and subsequent heat treatment the result may be costly and disastrous to the railroad. Alloy steels will almost unquestionably be used more by railroads in the future than in the past, and the principal condition now preventing intensive and advantageous use of this material is the fact that railroad blacksmith shops do not have the proper equipment and trained personnel for uniformly accurate heat treatment. The average blacksmith shop is seriously deficient in the right kind of furnaces, quenching media, and temperature control equipment. Pyrometers are needed, and, more than that, operators with sufficient skill and experience to know how to use them. It is the job of the blacksmith foreman to develop these operators and use his influence in getting the equipment necessary for the modern heat treatment of modern steels.

It would hardly be in order here to mention specific alloy steels, but a brief reference to what is being done in testing a chrome nickel steel, as a substitute for engine bolt iron on two large western roads, may be of interest. On one of these roads this material has been under test about two years on eleven different locomotives for bolts and pins as shown in Table 1.

Table 1—Chrome nickel steel locomotive bolts

Cylinder joint bolts
Frame splice bolts
Cross head guide bolts
Crank pin collar bolts
Front pocket and frame bolts
Cylinder saddle bolts
Expansion pad bolts
Equalizer fulcrum bolts
Cross tie bolts
Front pocket studs
Cylinder frame studs
Boiler studs
Valve motion pins
Spring hanger pins

On one locomotive, which was rebuilt, practically all of the bolts and pins put in were of this steel.

For the general run of bolts and studs the material was given a 1,525 deg. F. water quench and 1,100 deg. F. draw to produce physical properties such as shown in Table 2.

Table 2—Physical properties of a chrome nickel steel

Properties considered	Annealed 1550 deg. F.	Water quenched 1525 deg. F. Drawn 1100 deg. F.
Tensile, strength, min. lb. per sq. in.	75,000 lb.	110,000 lb.
Yield point, min. lb. per sq. in.	50,000 lb.	90,000 lb.
Elongation in 2 in. min. per cent	24.	20.
Reduction of area, min. per cent	45.	55.

Annealed alloy steel for boiler studs is the recommended practice on one of these roads as they believe that the more ductile annealed material will work out better since it is often necessary to bend these studs after application in order to get the holes in the brackets to line up properly. For valvemotion pins, the material is given a 1525 deg. F. water quench and 425 deg. F. drawback to produce a good wearing surface. With this treatment the steel will Brinell around 444.

This test has been going on for almost two years and practically all of this material is still in service. On another road a similar test on several locomotives has been under way for over a year, and this material is still said to be showing up satisfactorily.

The advantages of alloy steel for this purpose over the old practice of using engine bolt iron or mild steel are said to be as follows: Uniform structure throughout with freedom from defects such as seams and slag pockets so common to bar iron; higher physical properties; prac-

tically no losses in process of manufacture due to freedom from unwelded seams and slag pockets which result in scrapping many bolts when iron is used; lower maintenance cost due to longer service life which this material will give over iron and carbon steel.

The blacksmith foreman can perform no greater service for his road and for himself, therefore, than to become thoroughly familiar with the service afforded by, and the proper forging and treatment of all kinds of carbon and alloy steels adaptable to railroad service. In his spare time he can investigate the proper handling of aluminum allays, the possibilities of X-ray inspection to locate flaws in steel, the merit of chrome plating as a wear resistant and a hundred other new developments. Possibly he can find an opportunity to ask himself how he is going to develop all-around blacksmiths and capable assistant foremen when so few boys are willing to undertake apprenticeships in the blacksmith's craft.

Truly, it may be said that few, if any members, of the modern railroad organization have a greater opportunity to contribute to successful and efficient operation than the master blacksmith.

Steel and its treatment

By W. C. Schofield

Blacksmith foreman, Illinois Central, Chicago

The quality of high speed steel is being improved, as well as what it will do when properly treated. I can not add anything more about how to forge and treat than is given by the many high speed steel makers. There is one point, however, that does not seem to be fully understood and practiced; that is, the high draw from 1,050 deg. to 1,100 deg. F. Many of you have found that a high speed steel tool that has not been given the high draw will be softer after the first day's use for this reason. It is a fact that high speed steel is harder drawn to 1,050 deg. F., than when only drawn to 750 deg. F.; that is, it takes secondary hardness. So when a high speed tool is not given the high draw, it is softened by heat generated in cutting, and, when cold, will be softer than when first put in service.

Metallurgists and heat treaters can learn from the other, and the cooperation of the two is in my opinion responsible for the wonderful progress that has been made in the past 20 years. The success has also been materially helped by cooperation of the steel makers in developing a particular steel to suit the performance required in certain kinds of service.

It would hardly be proper to give any specific heat treatment of any part of a locomotive as we have so many kinds of steels to be used, and each particular kind of steel requires a different treatment. I will, therefore, give what in my opinion are the essentials with any steel. It is my opinion that heat treatment begins in the mill when the ingot is cast and depends on how it is heated for rolling or pressing to size and then how the billet or bar is heated for hammering or pressing to shape, and, lastly, how it is heated for final heat treatment.

The forge man should not be held responsible for forgings made from a billet or bar from a mill that does not know how to make good steel, nor should the final heat treater be held responsible for a forging that has been improperly heated or forged.

It is my opinion that the human element is the greatest factor in successful heat treatment, from the mill to its final treatment. We regard first-class pyrometer equipment as absolutely necessary, but without brains to handle it efficiently the result will be a failure.

We will assume that our purchasing agent has obtained the steel from the most reliable source. The steel billet, alloy steel especially, should be placed in a cold furnace to be preheated and not allowed in the beginning to be struck by a direct flame. After being preheated slowly to about 1000 deg. F., it should then be transferred to the forging furnace and brought to a proper forging temperature. I will also say that a good forging furnace for steel is a rarity.

Now, who or what is that tells how the billet should be placed in the furnace so the heat will circulate all around it? Who or what is that tells when the billet is thoroughly heated as might be indicated by the pyrometer? Who or what is that tells when the top, bottom and center are heated alike? Who or what is that tells that each heat is alike? Scientists might say that the pyrometer and heat control and time will do all this, but we know it is the skill and intelligence of the heater in conjunction with the pyrometer equipment.

To me, the most apt illustration is given in Bullens, "Steel and Its Heat Treatment". Bullens says that while a good cook stove is essential to cooking, it alone does not make a good pie.

The forge man or hammersmith must be skilled, or the piece will not be properly forged. After being properly forged, it is ready for final treatment. It should have a suitable furnace with pyrometer and heat control equipment. The first heat should be a normalizing heat. Then lower the heat for quenching, and then provide a suitable drawing heat; or, if air cooled, we will have, first, the normalizing heat that is just under the forging heat, then cooled in still air, then a lower heat for refining, and finally cooled in still air. Again, you may have all this equipment and give all kinds of instructions but without an intelligent operator your heat treating will be a failure.

Furthermore, we know that there is some bunk and bill about heat treatment from the way metallurgists will differ. The opinion of some metallurgists is similar to the testimony of an expert witness in a legal court—his opinion is favorable to the one who pays. Forgings should have a prolongation forged on one end to the size of the smallest section of test forgings. The engineer of tests should have suitable equipment to make physical and micro tests. The result of these will give all concerned valuable information as to what treatment is best and will be useful as a guide for the future, so, this makes it necessary that the test should be made from each charge heat treated.

Knowing that the present success of the heat treatment in the automobile industry has been reached only after many trials and tests, I would offer this suggestion. The Mechanical division of the American Railway Association, should appoint a committee to make sufficient experiments and tests of steels and heat treatment for the most particular parts of locomotives in order to find out what would be the best material and how it should be heat treated to give the best results.

In my opinion this committee should be unbiased and have no preconceived ideas of what would be best, but find out from actual trial and test. Then we will have a certain kind of steel and know how it should be treated for every vital part of a locomotive.

Reclamation

By N. D. Wright

Superintendent of reclamation and supervisor of forging, Pere Marquette, Grand Rapids, Mich.

Of those features most essential to a successful reclamation department, I place first of all harmonious co-

operation with the stores and accounting departments. Lacking this your reports are worthless and you cannot say definitely with regard to any item whether you are handling it at a profit or at a loss. In checking items showing a red figure on the reclamation report, I have so often found them due to improper information furnished the accounting department that I cannot refrain from stressing this point. The store too, innocently enough, will often function against the best interests of the reclamation department unless the fullest co-operation obtains between the two. I refer here in particular to material shipped to the store department as second-hand, which in reality is scrap. Unless called attention to by the reclamation plant forces and correction made, your reports reflect an increase in cost and a decrease in savings where no such fluctuation actually exists.

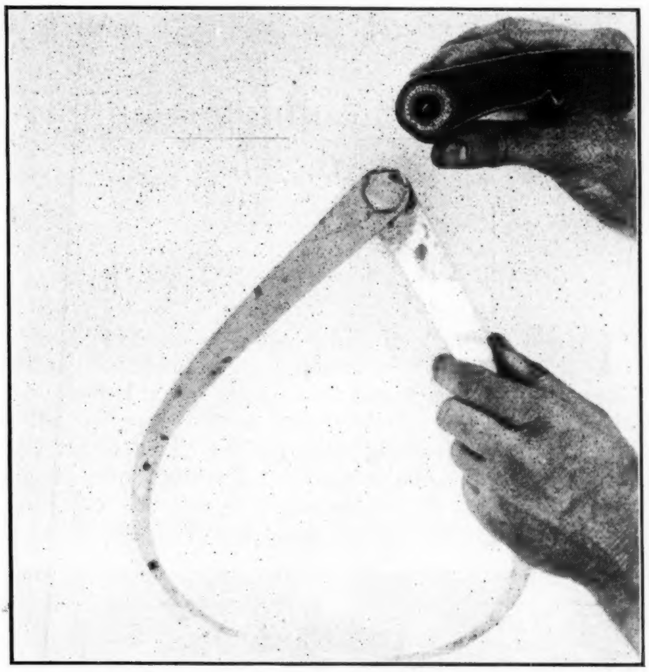
Second in order, though perhaps equal in importance, is the current market price of scrap and the new or manufacturer's price on all articles reclaimed in your plant. I have visited reclamation plants for comparative purposes and, upon checking individual items, for my personal information, found them salvaging material that should have been scrapped and new purchased outright. Of course, in emergencies, where the demand is immediate and the delay incidental to purchasing outside prohibitive, the reclamation plant can and should meet the situation. But it is only in emergencies that material or parts should be reclaimed at more than current market prices. It would be a long time between dividends in a business so conducted, at least when such losses are not offset by savings on other articles. But it need not occur as the market prices on both new material and scrap are easily obtainable, and in my opinion a reclamation department head is not proficient without this information at his finger tips.

In this connection I can hear some of you say that market prices concern the purchasing rather than the reclamation department. While there is a large element of truth in this, I urge all friends of reclamation to get acquainted with the purchasing department forces on your respective roads. We on the Pere Marquette have done so to our mutual advantage in many, many ways. To illustrate: When it comes time to order repair parts for brake beams, we check to determine whether parts can be purchased cheaper than they can be cast, on our contract, or vice versa. On washers, I have seen the time when we could buy them cheaper than it would cost to pick them up and sort them; again there have been times when I have shown a good profit on washers. Retapping nuts is another item that fluctuates. These serve to illustrate my point and are typical of dozens of items that can and should be watched in the same way.

I have reserved for the last a few remarks as to the reclamation plant itself. Too often the opinion prevails that because this department deals in scrap and second-hand material, and broken articles generally, any old quarters and equipment will suffice. Nothing could be further from the truth. A reclamation plant on such a basis will reckon its profits in cents, rather than dollars, if it can show a profit at all. On the Pere Marquette, at Saginaw, Mich., we completed a new reclamation plant last April, and during that month, though we were not settled and hence not operating within 50 per cent of full capacity, our net earnings were 65 per cent on second-hand and 98 per cent on new basis. The old slogan that to make money you must spend money is equally true in the reclamation game. That is the keynote on the Pere Marquette—make and save, and there is not a foreman in any capacity who doesn't consider it.

Neat way to handle small strips of emery cloth

WHEN using small emery cloth strips for cleaning and polishing surfaces, they can be handled very conveniently by holding them around a short piece

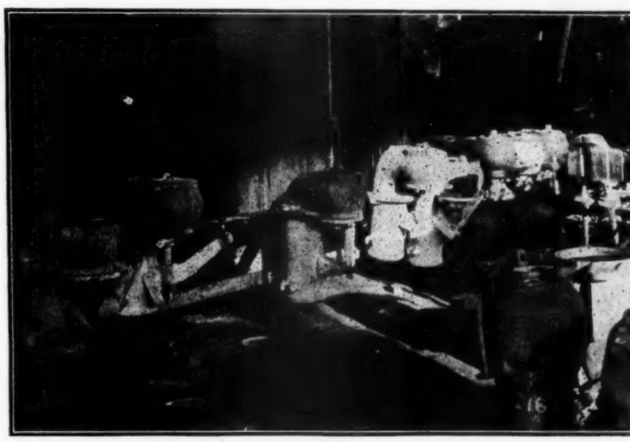


A piece of rubber hose facilitates the handling of small strips of emery cloth in hand polishing operations

of old hose as shown in the illustration. The hose gives the fingers something to grip, rolling it keeps fresh cloth in contact with the work and the hose affords a flat even abrasive action of the cloth over the work.

A throttle valve grinding rack that saves time

THE rack shown in the illustration is built to hold 12 throttle valves. Since this rack has been placed in service, a time saving of at least 1½ hours per valve has been accomplished over the former method of lay-



This rack for repairing throttle valves has saved 1½ hr. per valve

ing the valve on a bench, owing to the fact that the rack has provided a more convenient method for grinding and repairing the valves.

This rack is constructed of angles of sufficient strength to provide a stiff construction. The horizontal flange of the top angle is drilled to suit the bolt holes in the supporting flange of the throttle valve. The lower portion of the valve rests against the bottom rail of the rack.

Device for machining locomotive packing rings

By W. Salmon

Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.

The illustrations show a tool post and chuck in which 44 different sizes of locomotive packing rings can be machined, complete, on a lathe. With the aid of this device, the writer supplies all of the locomotive packing rings for the Chicago, St. Paul, Minneapolis & Omaha system. Packing rings ranging from 18 in. to 28 in. in diameter can be held in the chuck. With this chuck and a special tool post, an average of 50 of the largest size packing rings can be machined, complete, in an eight-hour day.

Spaced equidistant around the circumference of the chuck are ten threaded screws tapered on the ends similar to a lathe center. Each of these screws fits into small pinion gears which are all moved simultaneously by a master ring gear located inside of the chuck. The ten screws are moved in and out of the chuck by turning the master gear. This is done by inserting an iron bar in one of the eight holes in the outer hub of the chuck. The right hand of the machinist shown in Fig. 1 is holding the bar in position to operate the master gear. The ten screws have a maximum travel of 5 in.

Also located at equal intervals around the circumference of the chuck are three small rod gages, each of which has a tee handle at the top. These gages are shown in Figs. 1 and 2. They are used when chucking a number of packing rings of the same diameter. Before the finished ring is removed, these rod gages are brought up flush with the inner circumference of the packing ring and locked in position. The ten screws are released, another ring put in and quickly centered in the chuck by means of three bar gages, without moving the chuck around by hand. When the ring is centered on the 10 screws, they are drawn tight against the inner surface of the ring. Figs. 1 and 2 show a sleeve around each of the screws. These sleeves are used only when the screws are extended out to their maximum distance, to prevent them from wobbling. Fig. 3 shows an 18-in. ring mounted on the chuck. In this case the sleeves are not required.

A special tool post and set of tools were also designed in order to complete a ring in two operations without the necessity of changing the cutting tools.

The shanks of two U-shaped toolholders are held by set screws in the top member of the toolpost. Toolholder No. 1, shown in Fig. 4, contains three small cutting tools ground vee-shape. These three tools are used to face the two sides of the ring, bevel all four corners and cut a small oil groove in the center of the face of the ring. Toolholder No. 2 contains two cutting tools which are used to finish the ring to size. The tool bits are held in place by set screws which make it an easy matter to remove them for grinding or replacement.

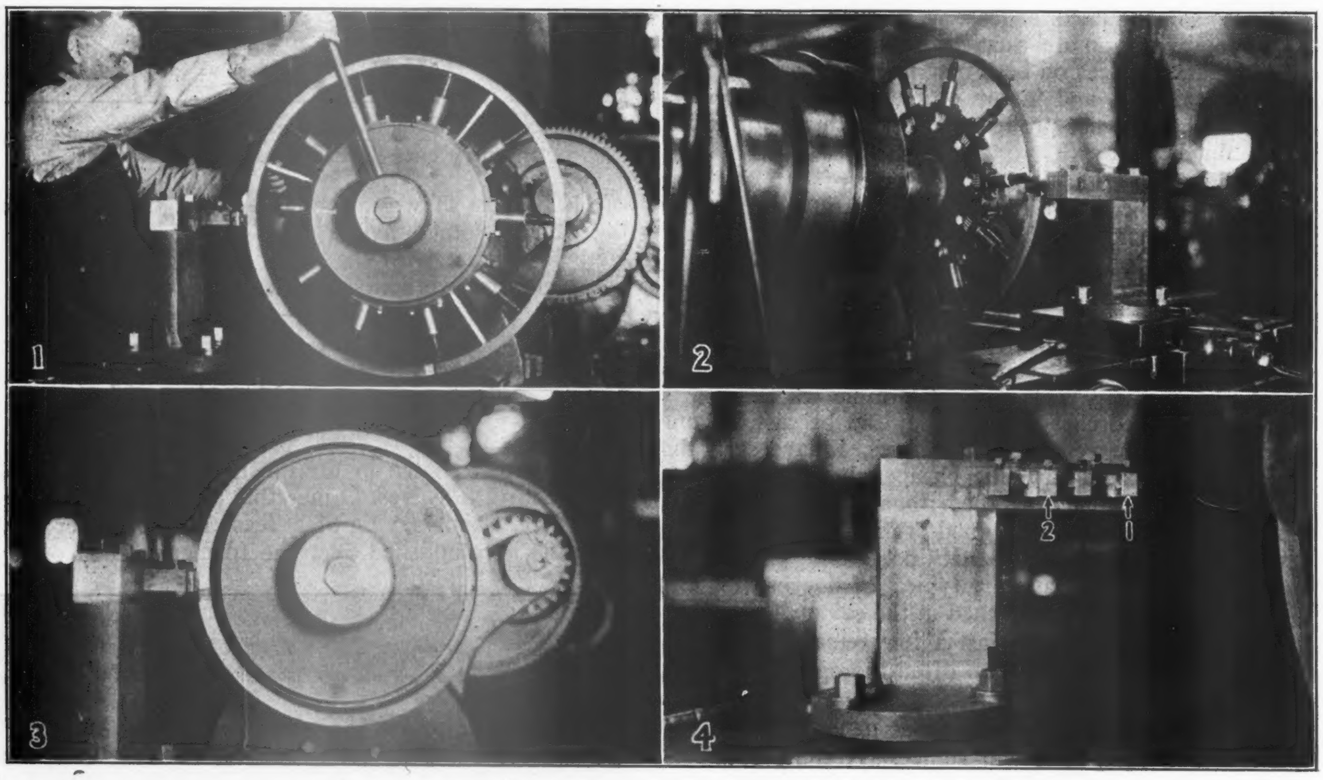


Fig. 1—The chuck with the gage rods and the screw sleeves in use; Fig. 2—A rear view showing the small gears which are operated by the master gear; Fig. 3—An 18-in. packing ring ready for turning; Fig. 4—The tool holder

View of Riverside engine terminal from the top of the coaling station

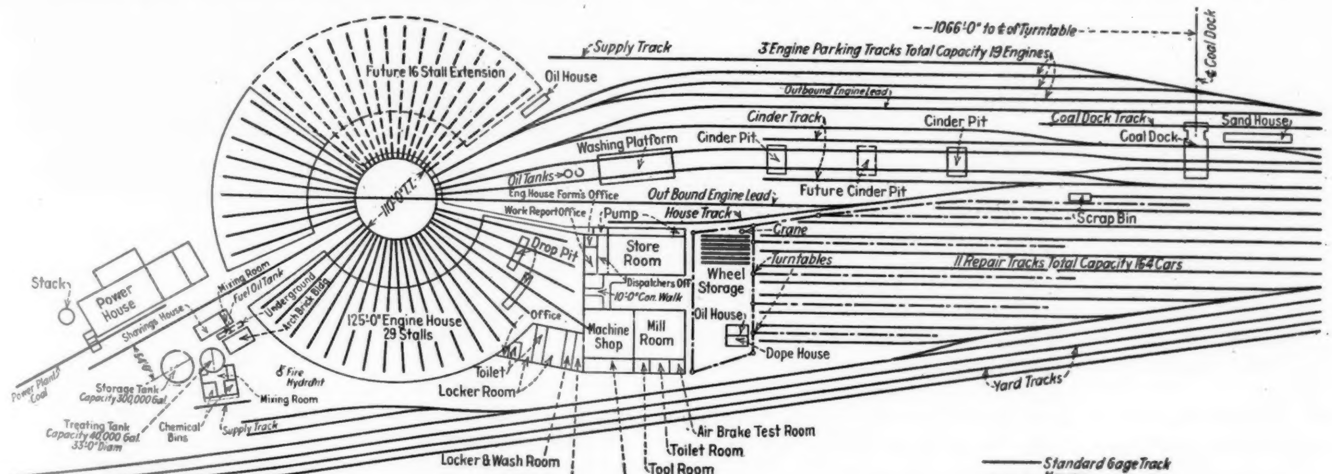
Big Four Riverside terminal at Cincinnati

A new terminal designed to despatch 50 locomotives a day— Direct steaming installed to minimize smoke and fuel losses

THE Cleveland, Cincinnati, Chicago & St. Louis, on March 1, 1928, placed in service at Cincinnati, Ohio, a 29-stall enginehouse with necessary power plant and service buildings. This replaces an 18-stall enginehouse built in 1891 which was inadequate to handle the volume of business going through the Cincinnati gateway.

In designing this enginehouse, considerable thought was given to the possible future increase in the length of motive power. In the past the treatment of this phase of terminal designing has been shortsighted, resulting in obsolescence of buildings after only a short portion of their normally useful life. Therefore, an inside length of 125 ft. was adopted, placing the back wall 245 ft. 4 in. from the center of the turntable.

The site for this enginehouse is located between a residence district and the Ohio river. This location made necessary a careful investigation of available methods for combating the smoke nuisance which makes an engine terminal objectionable to owners of adjacent



The layout of the Riverside engine terminal of the Big Four at Cincinnati, Ohio

property. Several systems for collecting and washing the smoke were considered and abandoned because of high operating cost and repair charges, caused by the action of acids present in the gases. After several tests in collaboration with officers of the Cincinnati smoke inspection department, it was decided to equip this terminal with the direct-steaming system. This system consists of a supply of high-pressure steam generated economically in a stationary power plant and conveyed to the locomotive through a high-pressure steam main. When operating under this method a bed of coal is prepared in the firebox, but is not ignited until the locomotive is on the outbound lead. Efficient combustion is obtained and, even at the initial period, no violations of the local smoke ordinance are observed. The necessary time period between leaving the enginehouse and leaving the train yards in freight service allows the fire to burn through, causing no trouble from that source.

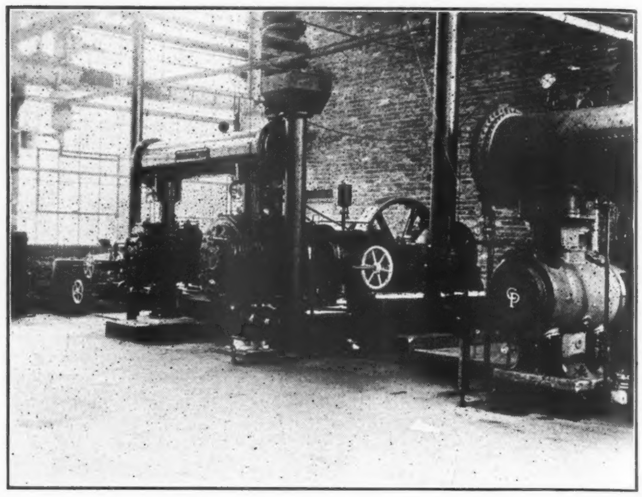
The Riverside terminal is designed to dispatch an average of 50 locomotives daily, of which approximately 58 per cent are in passenger service, 22 per cent in freight service, and the remainder in yard service. Passenger and freight power is dispatched for operation over the Chicago division, with a mileage of 303.3. Passenger power is also dispatched for operation over the Cleveland and Detroit divisions, with mileages of 262.2 and 271.9 respectively.

The boilers in the power plant are stoker fired—The coal is weighed in an overhead lorry and distributed to the hoppers

The boiler plant

The replacement of individually-fired locomotives by a power plant naturally increases the size of this unit beyond that usually required for servicing the ordinary enginehouse of this size. The boiler room equipment occupies a room 50 ft. by 100 ft., having a clear space of 30 ft. under the roof trusses. The boiler equipment consists of five 416-b.hp., four-drum Heine vee-type boilers, built for an operating pressure of 200 lb. gage.

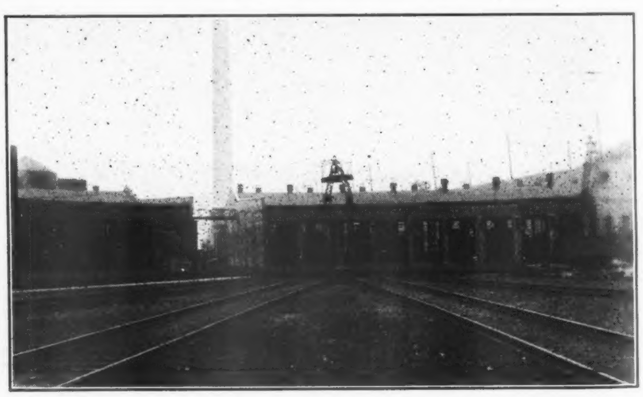
Under these boilers, with mud drums set 10 ft. above the floor line, are Type E stokers furnished by the Combustion Engineering Corporation. The air for combustion is delivered by a 68,000 c.f.m. Clarage fan and engine-connected with a Texrope drive. A 100-hp. variable-speed motor is installed as a standby unit. A 12-ft. diameter by 200-ft. reinforced concrete stack gives ample provision for the removal of the products of combustion, even when operating at a high boiler rating. The fuel for this plant is delivered by gravity into a track hopper, from which it is conveyed to a 50-ton steel overhead bin by a Beaumont skip hoist. From this bin it is delivered by gravity into an electrically-operated, one-ton overhead weigh-lorry, and distributed to the stoker hoppers.



Compressed air for the terminal is supplied by two steam-driven compressors in the power plant

The ash is pulled directly into the openings of an 8-in. United steam jet ash conveyor, through which it is discharged directly into an open car. This method of discharge was selected to dispense with the usual overhead ash bin and eliminates the usual winter difficulties, resulting from the freezing of ash in the overhead container.

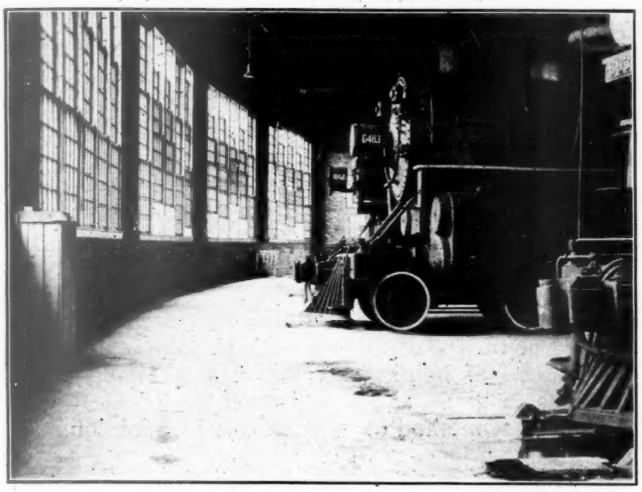
The boiler feed water is delivered by duplicate units of 300-g.p.m. Gould centrifugal pumps driven by G. E. turbines. The feedwater is obtained from the filling tank of the National Boiler Washing system and enters one of the duplicate 2,500-b.hp. Hoppes vertical feed-water heaters at a temperature of 180 deg. F. There it is further heated by exhaust steam before going to the boiler feed pumps. Inasmuch as there is a variable amount of exhaust steam available, these heaters have been installed so that surplus exhaust steam, instead of discharging to the atmosphere after leaving the heater, will enter one of the condensers of the boiler washing system and, after condensation, be



The inner circle and the 115-ft. turntable—The power plant adjoins this section of the house

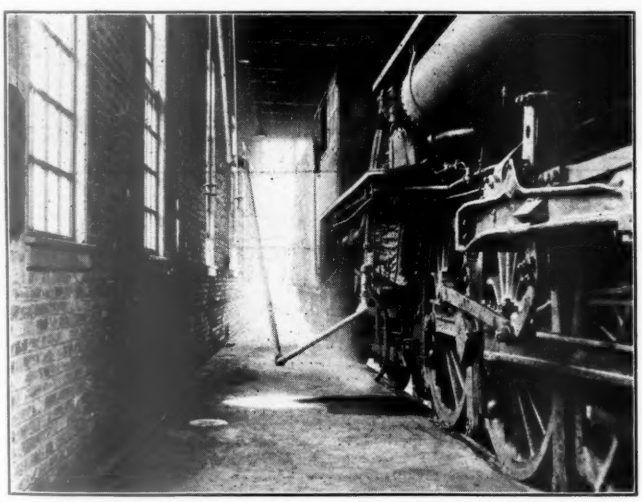
stored in the filling tank. The performance of these boilers is shown by an installation of Republic steam flow meters and a CO_2 recorder.

The air requirements of this terminal are taken care of by two steam-driven air compressors, one of the Chicago Pneumatic Tool Company 1,150-c.f.m. type, and the other a Worthington 732-c.f.m. type. The air intakes on these machines are guarded by Reed



The back wall of the house is 245 ft. from the center of the turntable providing ample room for modern power

air filters. The power plant building also contains the indirect heating equipment for the enginehouse proper, consisting of cast iron "Vento" radiation and turbine-driven Sturtevant fans. These turbines are installed so as to act as reducing valves and will furnish sufficient exhaust steam for the heating stacks in all but the most severe weather. The boiler washing facilities for this



The direct steaming connections are 2-inch pipe with flexible pipe connections

terminal were designed and installed by the National Boiler Washing Company and are installed in an annex to the power plant building adjacent to the boiler room. The pipe lines from this system, together with the high-pressure steam header, are carried overhead to the enginehouse.

The piping installation in the enginehouse follows generally the usual direct-steaming layout, 2-in. drops from the blow-off, filling and steam mains connected through a booster fitting being placed at each stall, with a ½-in. bypass steam line provided for holding the locomotives under steam while awaiting call. Inasmuch as the demand for washing facilities is much less than that for steaming connections, the washout line drops were installed only at alternate stalls. An extension of the direct-steaming outlet is installed at each stall to provide steam to the locomotive blower connection, providing in this manner a facility for cooling the firebox when repairs are necessary therein.

Enginehouse facilities

The enginehouse is fitted with smoke jacks to take care of steam discharged through the blowers. These smoke jacks are equipped with hand-operated dampers to facilitate the retention of heat in the enginehouse during the winter months.

Two Cardwell spring tracks are conveniently located on two of the pits in the running repair section of the enginehouse. By their installation, the terminal is provided with two additional locations where springs may be as easily removed as on a drop table.

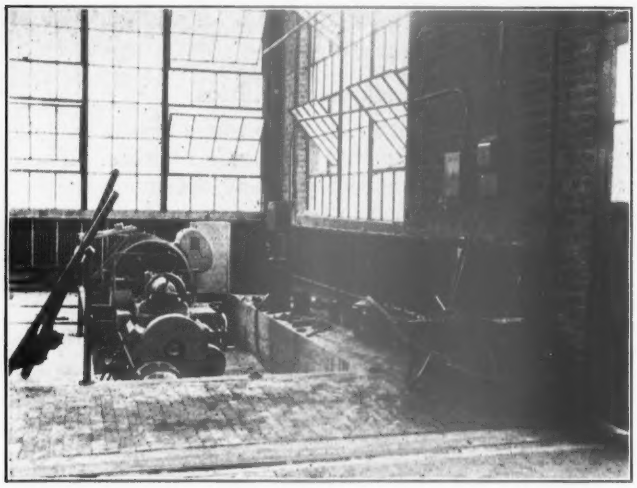
The coaling of locomotives is handled by a 500-ton mechanically-operated coaling station

In keeping with the remainder of the enginehouse design, the most modern equipment has been installed for the drop pit department. This equipment consists of one 50-ton Whiting electric drop table for handling driving-wheel work and one 30-ton drop table, so spaced as to take care of engine-truck, trailer and tank wheels. In this section of the enginehouse is located the charging equipment for the electric crane trucks.

An appreciable portion of the power serviced at this terminal is equipped with the Elesco closed type feed-water heater. To remove the incrustation formed on the heater tubes in service, a small duplex pump arranged for acid service by the application of an all-brass water end is mounted with a suitable acid container on a small portable truck. This outfit can easily be moved from pit to pit and, when connected to the house air line, provides an economical method of handling an otherwise time-consuming job.

The terminal service facilities are placed adjacent to the drop-pit section of the house. The southern wing consists of a single-story building, with a moni-

tor type roof covering the portion housing the locomotive and car machine shops. On the south side of this structure is placed a lean-to, in which is located the shop foreman's office, blacksmith shop, air brake room, tool rooms and toilet, and wash and locker rooms for both the locomotive and car-department forces. The washing facilities are adequately taken care of by a battery of Bradley wash fountains.



The journal turning lathe is installed in a pit so that wheels are rolled into the machine from floor level

Shop equipment

The locomotive department machine shop is a well-lighted room, 63 ft. 2 in. by 66 ft. ½ in. The equipment installed is shown in a table.

Equipment in the locomotive machine shop

1—36-in. by 10-ft. Niles engine lathe
1—21-in. by 10-ft. Le Blond engine lathe
1—20-in. by 6-ft. American engine lathe
1—20-in. Queen City shaper
1—36-in.—44-in. Niles side head boring mill
1—75-ton Elmes hydraulic bushing press
1—4-ft. Dreses radial drill
1—34-in. Snyder vertical drill press
1—33-in. by 33-in. by 8-ft. Cincinnati planer
1—18-in. by 3-in. Ransom double dry grinder

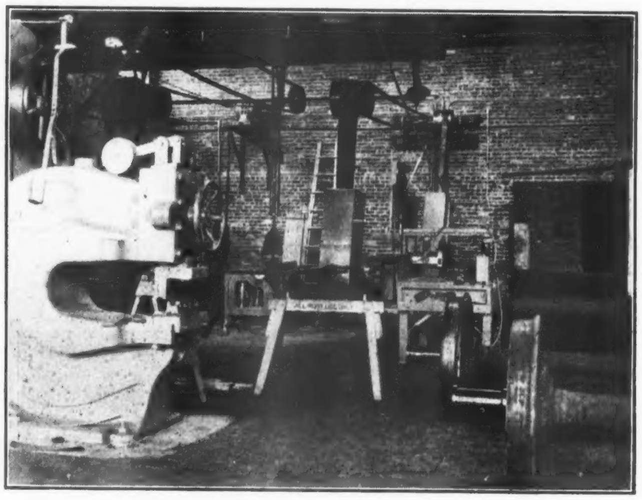
Direct access may be had from this shop to the drop pit section of the enginehouse, to the casting storage platform located between the shop and storehouse wings, to the car-department machine shop and to the blacksmith shop.

The blacksmith shop is designed to serve both departments. It is equipped with a Beaudry power hammer and all forges have individual motor-driven blowers.

Owing to the proximity of the machine tools of the locomotive department, the car-department machine tools are restricted to a 24-in.—36-in. Cincinnati-Bickford vertical drill press, a 2-in. Acme double-head bolt cutter, and a 24-in. Cleveland punch and shear. To take care of the wheels removed for rough journals at this point, a Betts-Bridgeford fixed-gap double-end mounted journal turning lathe has been installed. This lathe is installed in a pit and is served by a traveling lorry car so that one operator can easily take care of all work of this nature. The class of equipment repaired at this terminal includes a considerable number of wood cars. For their repair a small amount of woodworking machinery, consisting of a rip saw, horizontal borer and mortiser, band saw, and a Dewalt Wonder Worker was installed.

A two-story and basement building comprises the north service wing. The enginehouse foreman, work-report clerk and the engine despatcher are housed on the first floor adjacent to the enginehouse. A store room, 47 ft. 10 in. by 99 ft. 6½ in., occupies the remainder of the first floor. It is provided with a car-level floor and a basement which is accessible through a double ramp. The second floor of this wing is occupied by facilities for engine crews, an assembly room, and offices of the car department forces. The car department offices are exceptionally well located, as the repair tracks are at all times directly within vision of the supervisory forces.

The lighting of the enginehouse is taken care of by the installation of six 200-watt lamps at each stall. These lamps are housed in Benjamin fixtures and are distributed along the center line between the stalls. They are placed about 15 ft. above the floor line, thus giving direct illumination to the working parts of the locomotive and casting a diffused light over the upper portion. The main feeder lines run around the outside of the back wall, with a separate fused switch for each stall. The stall wiring is enclosed in conduit and further protected by wood sheathing. Ralco receptacles are also provided at each stall for use with portable extensions. This method of lighting was adopted to eliminate the objectionable glare which had been experienced with the flood light method of enginehouse illumination.

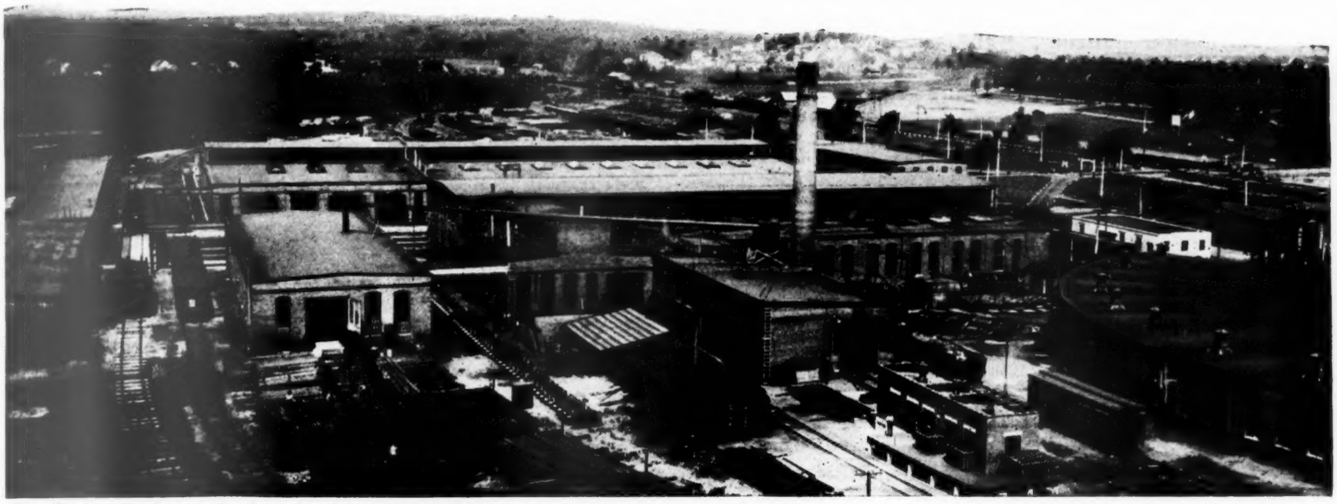


A corner of the car department shop

Saving in fuel by direct steaming at Riverside Terminal

Total coal used in power house March 1, 1928, to April 24, inclusive		4,950,000 lb.
Total coal used by washout plant and air compressors		626,000 lb.
Total coal used for direct steaming		4,324,000 lb.
Total despatchments same period		2,020
Coal used per despatchment in power plant	2,140 lb.	
Coal used per despatchment in firebox	750 lb.	
Coal used per despatchment—Total		2,890 lb.
Coal used to fire-up—Old method	2,300 lb.	
Coal used in power plant for blowers—Old method	710 lb.	
Coal used to hold under steam	720 lb.	
Coal used per despatchment—Old method		3,730 lb.
Coal saving per despatchment		840 lb.
Coal saving per year, tons		6,070.6
Coal saving, per cent, by new method		22.52
Cost of coal per ton on locomotives	$2.918	
Cost of coal per ton at power plant	2.623	
Saving per ton on labor	$0.295	
Saving per year on labor = (Coal used in power plant, tons per despatchment, new method, minus tons coal for blowing per despatchment, old method), times yearly despatchments, times saving per ton = $\frac{1,430}{2,000}$ times 14,454, times .295 =		$3,048.70
Saving per year on actual tonnage reduction = 6,070.6 times 2.918 =		17,714.00
Total estimated yearly saving =		$20,762.70

Note: The figures in the table are based on the actual coal consumption in the power plant for a 55-day period and are compared with operating conditions existing in terminals using the old steam blower method of firing.



The Bangor & Aroostook shops located at Derby, Maine

Bangor & Aroostook bonus system

The workman and the company both profit under the plan—Many factors are considered when making the time studies

In the early part of 1926, the Bangor & Aroostook inaugurated at its Derby, Me., shops a bonus system, by which the workmen are guaranteed their hourly rate when they are unable to make the bonus price established for a job. Both the Taylor and Emerson bonus systems were studied carefully, but it was found that these systems could not be adopted advantageously in a small plant such as the Derby shops. It was found more practicable to use a modification of these systems in order to simplify the accounting and to make its application clear to the worker.

The principal factors taken into account in the study, on which was based the bonus system finally adopted, may be classified under the following heads:

Former cost of operation
Cost figured from the time study
Cost figured at a reduction of from 15 to 20 per cent of the former cost, based on possible short cuts and modernizing the operation
Final assignment of man-hours allowed for the operation
Pro-rating the total bonus for an operation in proportion to the pay for the straight time worked where a standard operation is performed by a group working together

How the time study is made

The prices for the work under the bonus schedule were set only after a careful selection of the different jobs best adaptable to a bonus price and also after careful time studies were made of each job. The time studies are made on a fair, impartial basis. First of all, the men are told that a time study is being made. Every device, such as hoists, cranes etc., that will increase production, is put at their command. The speeds and feeds of the machines are checked to see that each machine is in condition to give maximum production. It is the duty of the time-study supervisor and the shop foreman to see that no delays chargeable to the management are incurred while the work is being studied. A history of the workman's normal day's work is obtained, and he is fully aware that he is being watched, but in such a way that he willingly lends his personal cooperation. After all of these factors are considered, time studies of several different jobs of the same kind are made, and from the average labor cost figures obtained, the bonus prices are set, usually with a reduction of at least from 10 to 20 per cent of the former cost.

When the bonus rates are changed

When the bonus rates are once set, the men are permitted to earn as much as they can. The amount of their pay check depends on their ability and resourcefulness in developing short cuts and labor- and time-saving devices. No matter how much a workman or a gang of workmen earns, the rates are never cut unless the company purchases modern machine tools or more efficient small tools. The company takes the position that it should be compensated for such expenditures, and the work is restudied and a new rate set. Great care, however, is taken in the assigning of new rates in order to assure the employee that it is not an attempt to reduce his wages, but an honest attempt to increase efficiency.

How the bonus system actually works

This system was first started in the machine shop and was first applied to the car axle lathe. At that time the average output for two men working an eight-hour day was four new axles, or six second-hand axles. The basic day under the bonus system was set at five and one-half new 5-in. by 9-in. axles, or six new 4¼-in. by 8-in. axles, or twelve second-hand axles. Under this schedule at the present time, one man is turning out in an eight-hour day, an average of nine new 5-in. by 9-in., or 4¼-in. by 8-in. axles, or nineteen second-hand axles. With this output, the machinist makes approximately one dollar an hour and, when a helper is used, about 75 cents an hour, where their former rates were 65 cents and 47 cents, respectively. At the same time, the shop output has been materially increased, and the price per axle decreased.

The Bangor & Aroostook recently carried out a program of modernizing many of its older types of locomotives. A part of this program included placing new cylinders on these locomotives. Therefore, one of the heaviest repair jobs on the erecting floor was that of

applying new cylinders. This job included all the work of removing the old cylinders and applying the new, except the manufacturing of the saddle and smoke-box connecting bolts, which was a bonus job by itself. Previous to the installation of the bonus system, the cylinder work averaged $179 per locomotive. The bonus price was set at $160, or a reduction of $19 per set of cylinders,

BANGOR & AROOSTOOK RAILROAD COMPANY
Locomotive Department

Derby Shops, Feb. 25, 1928.

Work Under Bonus Schedule

JOB: Running Gear Erecting — WORK COMPLETE 1-21-28
ENGINE: 322 — PRICE ALLOWED $190.00
TIME ALLOWED: HRS — LABOR COST $126.70
BONUS DUE $63.30

Name	Occupation	Hours	Rate	Pay	Bonus
Ralph P. Moore	Machinist	53½	70	$37.45	$18.71
Wallace J. Russell	Machinist	23	70	16.10	8.04
William R. Hughes	Machinist	10	70	7.00	3.50
Frank C. Dean	Machinist	35	65	22.75	11.37
Everett H. Adams	Mach. Helper	35	40	14.00	6.99
Francis D. Owens	Mach. Helper	50½	40	20.20	10.09
Forrest W. Strout	Mach. Helper	23	40	9.20	4.60
Total				$126.70	$63.30

Correct__________ Bonus Supervisor

Approved__________ Supt. of Shops

Form used for bonus pay of erecting shop workmen

a saving in itself of 10.6 per cent. During the months of December, 1927, and January, 1928, under this price one machinist and one helper, working 172 hours and 165 hours, respectively, applied three new sets of cylinders. This time represented 36 hours less than one month's work for the two men. These men averaged $1.70 per hour and $1.12 per hour, respectively. The company saved the $19 per cylinder, or $57 on the direct application, and had the locomotives out of the shop much sooner than could possibly have been done before the bonus system was established. The bonus system also helped to reduce the overhead expense because under the old system these two men would have been employed 459 hours, or 43 hours over two months to accomplish what they did in 36 hours less than one month and for $57 less direct cost under the present system. This increase in production was the result of the men making every minute count for something accomplished. Also, they improved their methods of doing the work, improved on the tools used, and, most of all, improved their time between whistles.

Another job that has recently been included under the bonus system is that of machining brass butt-end floating bushings. The time study showed the average cost to be $2.54 each. The price was set at $2 and, with this price, the machinist is now machining them in two hours, or for $1.40. He thus receives a bonus of 60 cents each.

Under this system, the company benefits in two ways. As an example, if the cost of a job is reduced from $6 to $5 as a result of the time study, the company saves $1 at the outset. If the employee does the work for $4.50, he receives a bonus of 50 cents and at the same time, the company gains by the increased shop output. The workman is protected in that, if he had completed the same job at a cost of $5.50, he would have received his usual hourly rate for the actual time worked.

How the records are kept

The clerical work has been made as simple as possible and is carried on by one man. A Stromberg electrical job clock has been installed which has the hours graduated in hundredths to simplify figuring. The men punch in on the clock when starting a job and the bonus supervisor inspects the work at that time. If a man is called on another job before he has completed his job on bonus, he punches out. The time from the job card is recorded on a bonus card. These cards are filed according to engine numbers so that when an engine is completed all the cards on that engine are filed away for future reference. The bonus supervisor inspects the work as often as possible and is aided in this inspection by the shop foreman.

BANGOR AND AROOSTOOK RAILROAD COMPANY

STATEMENT OF BONUS WORK

Mechanical Department — DERBY SHOP — Date_____19___

Engine No.________ Date Out Shop_______19___

Craft	Total	Hours Worked		% Hrs.	Av. Hourly Rate		Labor Cost		Gain to Men	
	Hours	D.W.	B.W.	B.W.	D.W.	B.W.	D.W.	B.W.	Dollars	Per cent
Machinist										
Mach. Helpers										
Mach. Apprentices										
Boilermakers										
B.M. Helpers										
B.M. Apprentices										

When this form is filled in it shows the amount of bonus pay charged against a locomotive in the shop for repairs

When a bonus job is completed, the labor costs are pro-rated according to the number and occupation of

the employees who did the work. This information is filled in on two forms, samples of which are included in the illustrations. One form covers the erection of the running gear. The price allowed for this work is $190. The actual labor cost was $126.70. This charge was pro-rated among four machinists and three machinists' helpers. The form shows the number of hours each man worked on the job, his hourly rate of pay, the pay he receives on an hourly basis, and the bonus allowed each man. Another form used shows axle lathe work which is done on a shop order. This form contains four columns in addition to the name and occupation columns. These four columns cover the shop-order number, the number of axles completed, the size and kind, and the bonus earned.

At the locomotive shop there is one group operation that formerly required the services of 11 men. Immediately after the bonus schedule was put into effect, 9 of the 11 men requested that two be taken off from the work, allowing but nine men to participate in the bonus. The psychology of the worker is manifested very strikingly in this instance. If two men were taken off the job, the earnings which these two men would normally receive under the bonus allowance, would be pro-rated among the other nine. This scheme was accepted by the management as a matter of business to show the co-operative spirit to help them to increase their wages, based on the principle of paying for production delivered.

Space will not permit a description of all of the many instances along the same line. A few of the most striking, however, will be pointed out to show how the men have taken to the bonus system.

THE BANGOR AND AROOSTOOK RAILROAD COMPANY

MACHINE SHOP BONUS

JOB Renewal of Tubes and Flues — DATE July 9, 1928

ENGINE 95 — PRICE ALLOWED $48.70

NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Time	Rate	Amount		Bonus	
Geo Wilkins									2.			5.	6.5																2	1.6		17.1	.65	11	12	15	45
H. E. Farris												5.	6.6																2.3	1.6		15.4	.47	7	24	10	06
E. P. Arsenault																														1.3		1.3	.47		61		85
I. B. Grinnell												1.5																				1.5	.47		71		99
C. A. Grinnell																													1.			1.	.70		70		97
							149	Tubes @ $.20 = $29.80																										20	38	28	32
							21	Flues @ $.90 = 18.90																													
								Bonus Price 48.70																													
								Labor Cost 20.38																													
								Bonus 28.32																													

BONUS SUPERVISOR F. R. Dollivar

Form used for recording bonus work in the machine shop

These forms are sent to the payroll department and the earnings credited to the proper employees. The men are paid each week, and the bonus checks are made out separately from the regular pay checks. This is done to avoid confusion between the two and to make it easier to check up when the men take exception to the amounts shown on either pay check.

The third form shown in the illustrations is the monthly statement of the amount of bonus work done at the shop. The column headings on this form show the number of hours worked, the total hours of bonus work, the per cent of total hours credit to bonus work, the average hourly rate of day work and bonus work, the labor cost according to day work and bonus work, the gain to the men in dollars and the gain to the men in per cent of total earnings. This form is submitted to the mechanical superintendent who can see at a glance how the labor charges are pro-rated, according to crafts to each locomotive that received a class repair during the month.

An operation recently started involved four men. After the assignment of the bonus rate, the men insisted upon a reduction of one man from their crew, which was readily assented to by the management. This suggestion from the men increased the earnings of the two machinists employed by $3.75 per week each, and reduced the cost of the work about 15 per cent.

Another striking instance was found in the car department during the construction of the first order of 100 standard A.R.A. box cars built at the Derby shops. Under this operation there was one group of four carmen and one helper. The carmen were under a piecework rate, while the helpers received a straight hourly rate and did not participate in the excess earnings of the other men. A plan was worked out whereby the workmen would take the helper on with them at three-quarters of their hourly rate. When first suggested to the crew, serious objections were made and, to overcome these

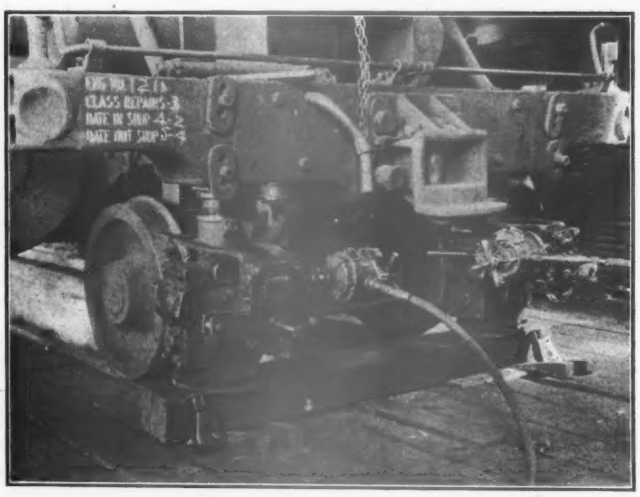
objections, certain suggestions were made to the men with reference to how they could increase their hourly production. In one instance, the rivet heater was placed on planking thrown across the center of the car underframe. Two pits were also dug along the side of the truck assembling track and high-power motors were used to drive the nuts home instead of using a hand-operated wrench. After the first operation on ten trucks, the wages of the carmen and helpers had been increased about 40 per cent. This scheme of co-operation with the men was appreciated, not only by the helper, but has since been applied and accepted by all the men on similar work.

An operation on locomotive boilers formerly required five men and cost $288. When a bonus rate of $144 was assigned under the bonus system, the five men were reduced by the leader to two, with the exception that a third man is used but two days during the period instead of being continuously employed on the work. The bonuses on this work vary from $26 to $44 per locomotive, depending on the general design.

A summary of the benefits derived from the bonus system at the Derby shops was aptly set forth by W. G. Knight, mechanical superintendent of the Bangor & Aroostook, in the concluding paragraph of a report on the bonus system prepared for the management of the road. Mr. Knight said in part: "Production systems offer higher wages to employees, better co-operation since capital's and labor's interest are mutual and induce the practice of thrift among employees. The employee has an interest other than keeping on the payroll, which brings closer relations between the management and employee. He realizes, moreover, the cause and result of waste and is prone to bring it before his superior. The mental activity induced by the system makes the man more alert and contributes, in a small way, toward a liberal education. Indeed, he is eager to look forward in his plans for an increase in production, because he is assured of a share in his earnings co-incident with a reduction in unit cost."

Motor-driven jack for the erecting shop

OPERATING a pair of jacks under a locomotive is always a hard and tedious task. However, this difficulty has been overcome in one southern railroad shop by applying a gear and worm arrangement to the jack so that it can be operated with a compressed air motor. In this particular device, a 52-tooth gear has been keyed to the operating shaft of a Norton, 75-ton jack. The gear is rotated by a 6-pitch worm, one end of which is formed into a mandrel to fit the sleeve of the motor. The worm and gear is enclosed in the housing, which is secured to the jack by a removable bracket made of 2-in. by ½-in. iron. The horizontal arms of the bracket are drilled with a number of holes near the end. The closing portion of the bracket is held in place by means of two pins which can be adjusted to any one of the holes in either arm. The motor used in this particular case is a No. 1 non-reversible Little Giant.



Two jacks in position under the pilot beam of a locomotive set for raising clear of the engine truck

Portable pipe bender saves time

A portable pipe bending machine, operated by air pressure, has proved a time saver at the Denver shops of the Denver & Salt Lake, where it was originated. According to the shop foreman who developed the machine, it has cut in half the time formerly required to bend a set of superheater unit pipes. As it is mounted on wheels, it can easily be moved from one job to another.

The frame-work is comparatively light. It is 6 ft. high and supports a 14-in. by 12-in. air cylinder at the top. Several sizes of grooved semicircular forming heads are carried in a rack on the machine. The heads are held in the end of the piston rod by a cotter key.

Portable air-operated pipe bending machine

The pipe to be bent is laid on two metal spools, supported between a frame of two 1-in. by 6-in. steel bars. These bars are spaced 6 in. apart and contain notches in the top edges, every few inches, in which are placed the spindles of the spools.

Two long metal hooks on the back of the cylinder carry the air hose when the machine is being moved about. The air pressure is controlled by a small two-way valve.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Who can settle this argument?

CHICAGO, ILL.

TO THE EDITOR:

Having business to transact with a department foreman in a large locomotive repair shop, and arriving during the lunch period, I was vastly entertained by a heated discussion in which about 12 foremen participated, the gist of the argument being as follows.

Bill Kempt, air brake foreman, is of an inventive and studious type of mind, continuously on the lookout for new methods, not only in his own department, but in any other department of the shop. He is also taking a course in a correspondence school and is educating himself for any higher position that may come. Regardless of this, his department is frequently behind schedule.

Jack Rennie, machine foreman, is the other type, confining all his energy to his own department. He considers that it is none of his business that the air department is behind, and he does not care if a smoke stack is applied on the top or side of the boiler. His department is a model of efficiency, very rarely behind schedule. He is fully conversant with every detail and is able to give the exact date of completion on all operations. By his conversation, it was easy to see that he kept himself well posted by reading mechanical papers, keeping just a step ahead of the other fellow in both his own and neighboring shops. But, his interest entirely vanished in the argument on the details of air brakes. He says air brakes, or any work other than his own is of no concern to him. "My job," he said, "is machine foreman only."

Each man had his following, Bill Kempt's adherents claiming that a successful department foreman should have a fairly comprehensive knowledge of the other departments. Also, he should train himself for a higher position, or expect some college man to come in and fill it. The other faction contended that if Bill Kempt confined his thoughts and energies to his own department, he would not be behind schedule with the air brake work. That is what he is being paid for, and not for studying other foremen's jobs. The diversity of opinion expressed by these foremen in one shop was so pronounced that it would be interesting to learn the opinion of other railroad foremen on this subject.

Which type of foreman is of the most value to his company; Bill Kempt, who is striving to attain a higher position, or Jack Rennie, who is confining his time and energy to his own department, and does not interest himself in any educational matters at all, other than reading descriptions of new tools and machinery, while Bill, because of his knowledge of all departments, is quite capable of taking charge of either boiler, blacksmith or erecting shops? As far as general knowledge is concerned, he has even given little talks on matters of interest to other departments. Still, the work of his own department is behind schedule. Although his work is first class in quality, he says he is short of men, but others say his department compares favorably in this respect with all others, and that any one can get work out on schedule if given sufficient men.

GENERAL FOREMAN.

Second-hand draft gear prices too high

NEW YORK, N. Y.

TO THE EDITOR:

If you will refer to page 125 of the Interchange Rules, effective January 1, 1928, you will note that in changing draft gears, complete gears, removed on account of defective friction casings with or without other defective parts, are credited at 25 per cent of the price new. The prices listed in this rule are in general based on a slightly higher price than the railroads ordinarily pay, plus 15 per cent for stores expense; so, in effect, the credit amounts to about 30 per cent of the price which the railroads pay for a new gear. Considering that most of the parts are probably worn and some labor is involved in disassembling the gear to salvage the usable material, this allowance seems amply large. There is no change in this figure in the supplement. The 1928 rules further provided that when a gear was removed on account of any part or parts other than the casing being defective, a credit of 50 per cent of the price new should be allowed. In the supplement, this is increased to 60 per cent. I believe very few friction gears could be found which are worth 60 per cent of the price new after they have been in service long enough for some of the parts to become defective. It seems to me that the 50 per cent allowance was ample. Increasing this to 60 per cent, I believe, would tend to make draft gear conditions grow worse, because foreign roads will not remove a gear even if it is defective if they must allow 60 per cent of the price new for the few second-hand parts they may be able to salvage.

The rule further provides that second-hand complete friction draft gears containing one or more second-hand parts shall be charged at 75 per cent of the price new, complete. I do not know that I have ever seen any friction draft gears assembled with second-hand parts which would develop 75 per cent of the capacity of a new gear, and I feel certain that it is practically impossible to assemble a second-hand gear that would give 75 per cent of the service of a new gear. This provision of the rule would encourage railroads to throw together any second-hand parts they might have on hand and apply gears so assembled to replace gears removed on account of broken housings.

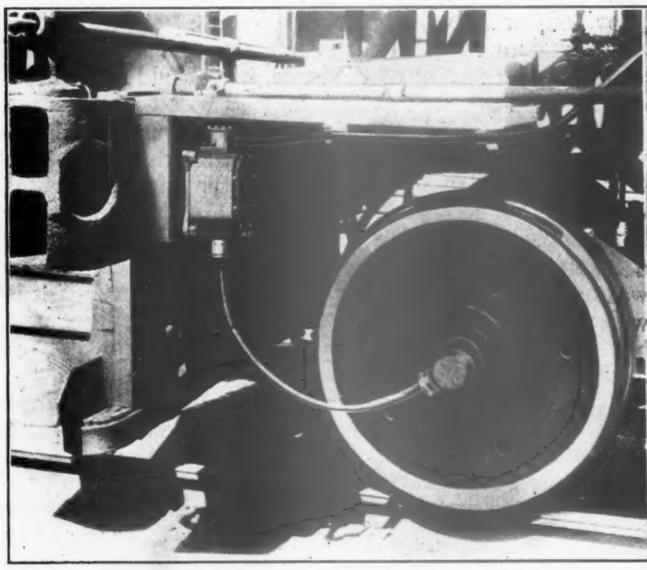
It is not unlikely that the 60 per cent provision of the rule in its present form was framed with the idea of discouraging replacement of draft gears on foreign lines. However, it does not seem that the operating road should be penalized if it replaces a draft gear to afford better protection to the car structure and lading and thus improve operating results in train service.

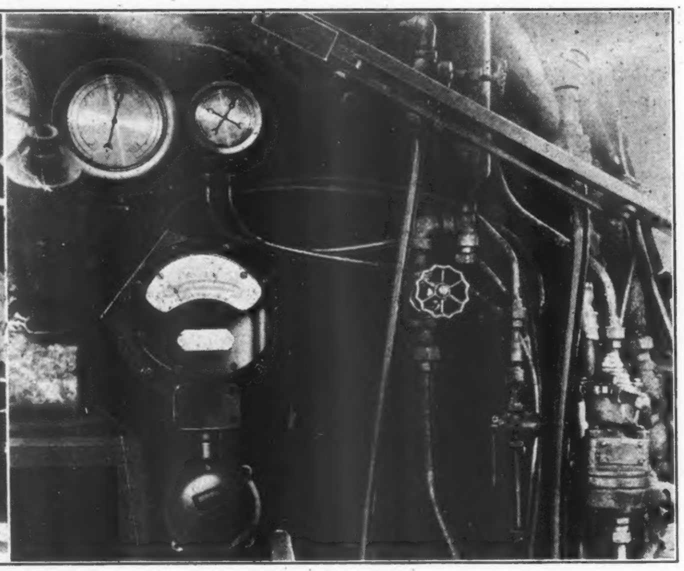
S. F. ALBERT.

An electric speed indicator for locomotives

THE railroad speed indicator, shown in the illustrations, is an electrical device manufactured by the Weston Electrical Instrument Corporation, 50 Church street, New York, for indicating the speed of steam and electric locomotives. It consists of a magneto generator, driven from a truck axle and generating a voltage directly proportional to its speed, connected by cables to a voltmeter indicator calibrated in miles per hour.

The electric type of speed indicator has no complicated moving parts, occupies but little space and can be installed in any location. The readings may be transmitted to any point on the locomotive by simply extending the connecting cables, and as many indicators as desired can be operated from one magneto. This is particularly advantageous on double-ended electric or oil-electric locomotives where it is necessary to have a speed indicator mounted in each end of the locomotive.





Left—The mounting of the magneto and flexible cable; Right—The cab indicator and rheostat in position

The Weston model 44 magneto unit, used as part of the indicator, is a direct-current generator having a permanent magnet field and revolving armature, provided with a commutator and two brushes. The armature shaft is carried in self-alining ball bearings. The brushes and commutator segments are made of a special hard non-corrosive alloy. The brushes are mounted on a self-alining brush holder, which equalizes the pressure on both brushes, and are so arranged that they may be easily removed and replaced.

The magneto is designed to generate an e.m.f. of six volts per 1,000 r.p.m. and is adjusted to have a resistance of 20 ohms and a maximum current output of .05 ampere. The voltage generated is directly proportional to the speed at which the magneto is driven; that is, the speed-voltage curve is a straight line. All of the magnetos are provided with an adjustable magnetic shunt, which allows the voltage generated to be raised or lowered about eight per cent.

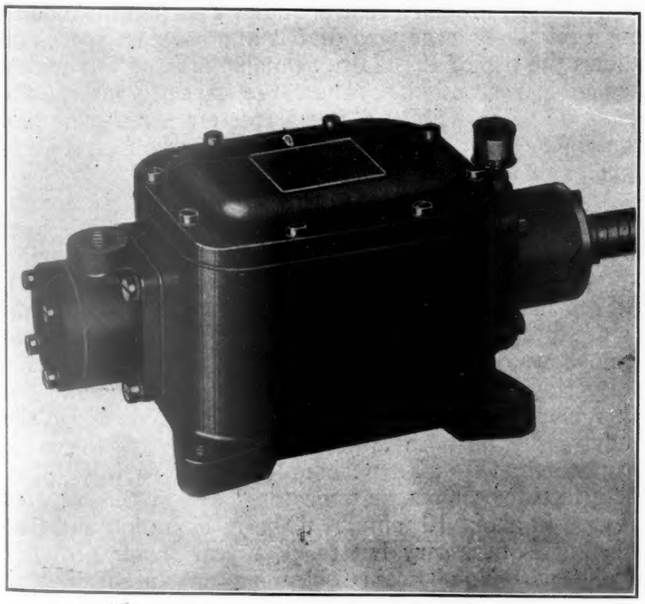
The speed ratio between the truck wheels from which the magneto is driven and the magneto is 1:2; that is, the magneto armature turns twice as fast as the truck wheel. For a given train speed, the speed of the magneto, and therefore, the voltage generated, will vary with different truck-wheel diameters. In order to correct for this, so that the voltage across the indicator terminals will be nearly the same for a given train speed with any truck-wheel diameter, an adjustable rheostat is connected in series with the indicator. This rheostat is

a set of series resistances arranged in steps, each step being marked in inches of truck wheel diameter, which, when properly set, adjusts the resistance of the circuit to the proper value for a given truck-wheel diameter.

The indicators are voltmeters of the permanent-magnet, movable-coil type, calibrated in miles per hour. They have an internal resistance of 500 ohms per volt and a sensitivity of .002 ampere for full scale deflection.

The rheostat for correcting the changes in truck wheel diameter

The total internal resistance of an indicator reading from zero to 80 m.p.h., is about 3,750 ohms. This resistance is constructed of manganin wire, having a negligible temperature coefficient, therefore, the accuracy of the readings is not affected by wide temperature variations. The resistance of that part of the circuit having a temperature coefficient (magneto armature and connecting cables) is such a small part of the total resistance that the effect of temperature changes on the indicator readings is not noticeable. This high internal resistance also makes the accuracy of the indicator readings independent of the size and length of the connecting cables and no



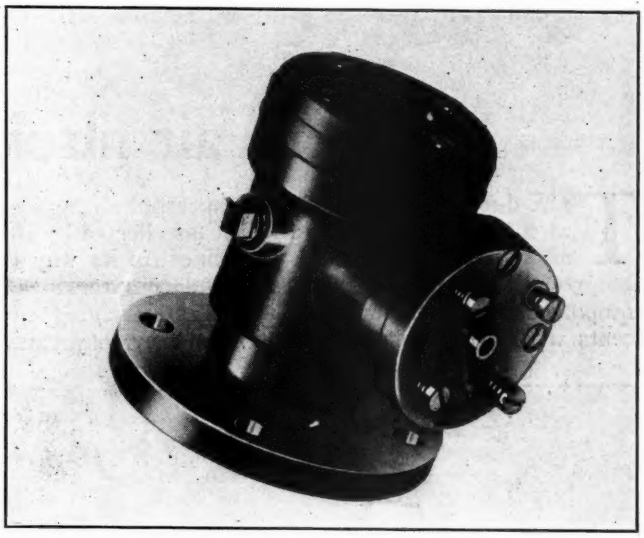
The Weston Model 44, Type D magneto, which is mounted on the locomotive frame

special adjustment for connecting cables is necessary. All of the magnetos and indicators are interchangeable.

The locomotive speed indicator consists of a model 44 Type D magneto, mounted on some part of the locomotive frame and driven from the end of a truck axle by a right-angle drive assembly and flexible drive shaft. A Model 493 cab indicator is mounted in some convenient location in the cab together with the rheostat to correct for changes in truck-wheel diameter.

The magneto unit is closed in a water-tight housing, on one end of which is mounted the outer shaft bearing assembly, the purpose of which is to carry the weight of the flexible drive shaft and to absorb any shocks that might be transmitted through the driving mechanism. The outer shaft is connected to the small inner shaft of the unit by a flexible coupling which prevents shocks and strains from being transmitted to the small magneto unit and facilitates the removal of the unit from the housing. Lubrication of the outer ball-bearings is effected by a spring-lock grease cup or any other suitable fitting. The grease is prevented from working into the housing by a labyrinth seal. Any excess grease works out into the flexible shaft sheath and serves to lubricate the drive shaft. No lubrication of the magneto unit itself is necessary.

On the opposite end of the housing is mounted a



The right-angle drive which runs on ball bearings carried on a steel shaft

water-tight terminal box fitted with a ½-in. pipe conduit connection, adjustable in four directions. The box contains two A.R.A. standard terminals to which are connected the cables leading to the cab indicator. All screws, nuts and bolts are locked to prevent their working loose under vibration.

The right-angle drive assembly contains hardened steel bevel gears enclosed in a grease-tight housing running on ball-bearings, carried on a steel shaft, pressed and welded into a steel plate, which is bolted on the end of the truck axle. The flexible drive shaft is connected to the pinion by a key, or pin, through the hollow pinion shaft which engages with a flat surface on one side of the end piece of the flexible drive shaft, thus forming a sliding connection which will transmit torque, but makes it impossible to put any tension strain on the flexible shaft when rounding curves, etc. Any tension strain is taken by the flexible shaft sheath, which is clamped to the gear housing.

The gear housing is made grease-tight where the shafts enter it by labyrinth seals. Lubrication and cleaning are provided for by two holes on opposite sides of the housing, which are normally closed by ¼-in. pipe plugs. One

of these holes may be provided with any desired lubrication fitting or grease cup.

The flexible-drive shaft is especially designed for locomotive service. It is a 3/8-in. four-ply, steel wire shaft, designed to run in either direction, enclosed in a strong flexible steel sheath filled with lubricant. The sheath protects the shaft against damage from contact with foreign objects, prevents whipping and swaying at high speeds, takes up tension strain due to deflection, and prevents the gear housing from rotating.

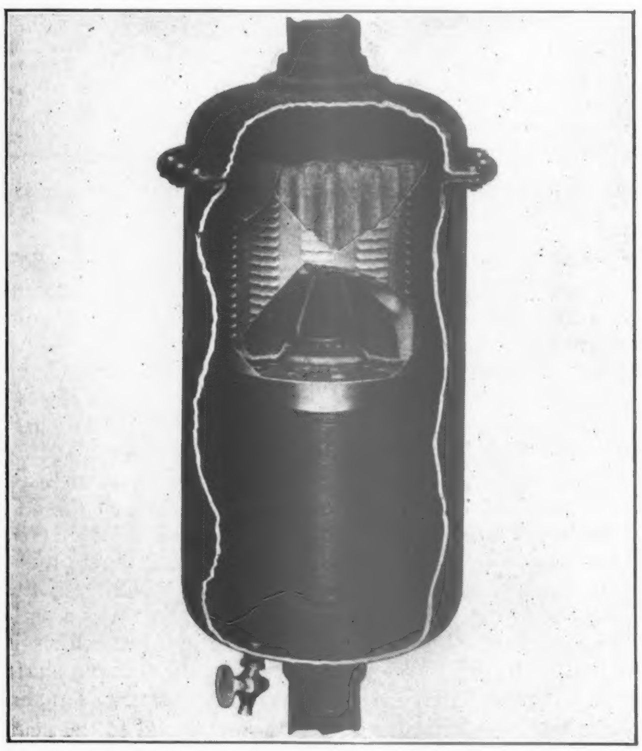
One end of the flexible shaft is connected to the magneto shaft by a shear-pin, which, if any damage should occur to prevent the free rotation of the magneto, will break off and allow the flexible-shaft and gears to revolve harmlessly and prevent further damage. The lower end of the flexible shaft is connected to the pinion shaft of the gear drive by a slip joint, which prevents any tension strain being put on the flexible shaft, and also allows the operation of connecting and disconnecting to be done simply and quickly. The ends of the shaft sheath are clamped solidly to the gear housing and magneto bearing housing by four 1/4-in. machine screws in each end. The end fittings of the flexible shaft and sheath are swaged by a special process, no soldered or brazed joints being used anywhere.

The rheostat for correcting for changes in truck-wheel diameter consists of a molded bakelite base, on which are mounted the resistance coils and terminals, enclosed in a water-tight box fitted with a screw cover and two 1/2-in. pipe conduit connections. Each terminal is marked with a number which represents the truck wheel diameter in inches. Adjustment is made by shifting the outer end of the connecting link on the center terminal to the outer terminal marked with the number which corresponds nearest to the truck-wheel diameter.

The cab indicator has an exceptionally rugged voltmeter movement enclosed in a water-tight case. The scale is long and easily read, and is calibrated from 20 m.p.h. backward, to 80 m.p.h. ahead. The scale opening is large enough to insure ample illumination from the regular gage-board lamp. The front of the case is of heavy plate glass, mounted in gaskets and protected by a cast-iron cover, except at the scale opening. At the bottom of the case is a water-tight terminal box, fitted with a 1/2-in. pipe conduit connection and containing two A.R.A. standard terminals to which are connected the cables from the magneto.

An air filter for pipe lines

THE dust, grit and water in compressed air, as well as the oil, rust and scale which is collected by the air as it passes through pipe lines on its way to compressed air tools, paint sprays, and compressed air equipment used in agitating liquids, are damaging elements which should be eliminated, for they may cause clogged air passages, worn parts and carbon, and thus lower the operating efficiency of the apparatus.



Sectional view of the Model CP pipe-line air filter

A filter which can easily be inserted in the air lines has recently been placed on the market by the Staynew Filter Corporation, Rochester, N. Y. It is claimed that it will remove dust, water, oil, rust, scale and other foreign matter from air passing through pipes and prevent wear and damage caused thereby.

This filter consists of an aluminum housing enclosed in a pressed-steel housing, designed to withstand a working pressure of 125 lb. Mounted inside is a felt filter medium, formed in radial folds over radial wire screen fins, grouped around a central outlet. This permits mounting a relatively large area of felt in a compact space and allows the use of the entire available area of felt with a negligible restriction. The large capacity inserts are designed to pass 250 cu. ft. of free air per minute and contain 20 sq. ft. of felt surface within a volume slightly smaller than a cubic foot.

As the air enters the top of the filter, it is thrown against the inner wall of a steel housing by a shield over the top of the filter. The downward velocity carries water, oil and most of the grit to the bottom of the shell. All remaining water, oil, dust and grit is said to be caught by the filter. A drain cock is provided at the bottom to remove water, oil and sediment.

By closing a valve to shut off the air going into the filter housing and opening the drain cock, the air in the outlet pipes or hose is blown back through the filter proper, removing all material on the filter surface. The manufacturer claims that the filter can in this way be cleaned in about 10 minutes while in operation and that cleaning is necessary but twice a year under ordinary conditions. No oil drain or cleaning tanks are necessary, and the filter does not have to be removed when once in operation.

SLING CHAINS.—Suggestions regarding the proper uses of chain and data relative to safe working loads on Taylor-Mesaba double sling chains when used at various angles, are contained in revised blue print, No. B, issued by the S. G. Taylor Chain Company, Hammond, Ind.

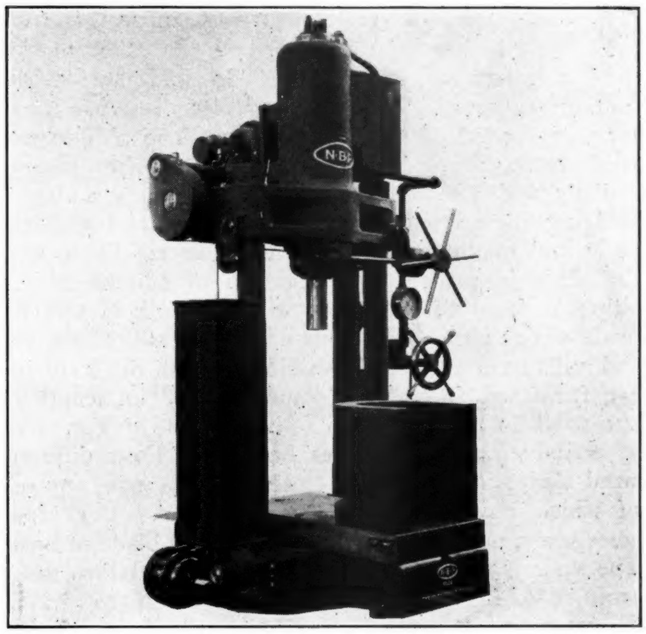
Niles 100-ton bushing press

THE illustration shows a motor-driven bushing press manufactured by the Niles Tool Works Company, Hamilton, Ohio, which is equipped with a special sliding table, provided with an in-and-out adjustment by a separate motor for pressing in and out driving box bushings.

The sliding table is mounted directly on the base plate and is traversed in and out by a 1-hp. motor. On this table is a heavy cast-iron block or step, with a U-shaped opening, on which the driving boxes are supported when pressing out the brasses. The block is removable when desired and has three pins at the bottom, which engage corresponding holes in the top of the table for centering under the ram of the press.

The traversing motor is reversible and has push-button control with suitable limit switches to prevent over-travel in either direction. The motor is connected to the table by worm gearing with a rack and pinion for imparting motion to the table.

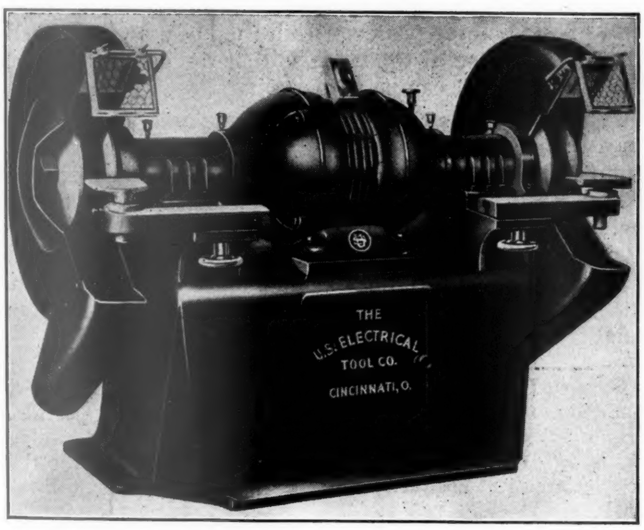
The machine has a capacity to press in or out brasses 20 in. long. The width between the tension bars is 34 in.; the stroke of the ram is 24 in.; the maximum height between the top of the sliding table and ram is 43½ in.; the pump, of the two-plunger type, is driven by a 7½-hp. motor by direct gearing.



Niles bushing press equipped with a special sliding table

High-speed grinding and snagging machines

A MACHINE, especially designed and built for high speed grinding and snagging, has recently been placed on the market by the United States Electrical Tool Company, Cincinnati, Ohio. A speed of 9,500 surface feet per minute is obtained on this machine with wheels 30 in. in diameter, having a 2½-in. or 3-in. face, and 18-in. hole and operating on 40 or 60 cycles. When worn down to 24 in. in diameter, the wheel turns at 7,500 surface feet per minute. Operating on 25- and 50-cycle circuits, the 24-in. wheels with a 2½-in. or 3-in. face and a 12-in. hole are recommended, giving 9,200 surface feet per minute. This machine is furnished for 220-, 440-, 550-volt, two- or three-phase alternating current, and 220-volt direct current.



A grinder which turns at the rate of 9,500 surface feet per minute

A 15-hp. motor is furnished which is designed for heavy duty grinding service, and built to A.I.E.E. specifications. It is rated for continuous service at full horsepower with a temperature rise of 40 deg. and with a momentary overload capacity of more than 100 per cent.

The machine is built to the American Engineering Standard code of safety. The wheel flanges are keyed to the shaft and securely clamped to the wheel by cap screws. Structural steel safety hoods over the wheels are built for wheel speeds of 10,000 surface feet per minute, and the doors on the safety hoods are also fastened on by cap screws.

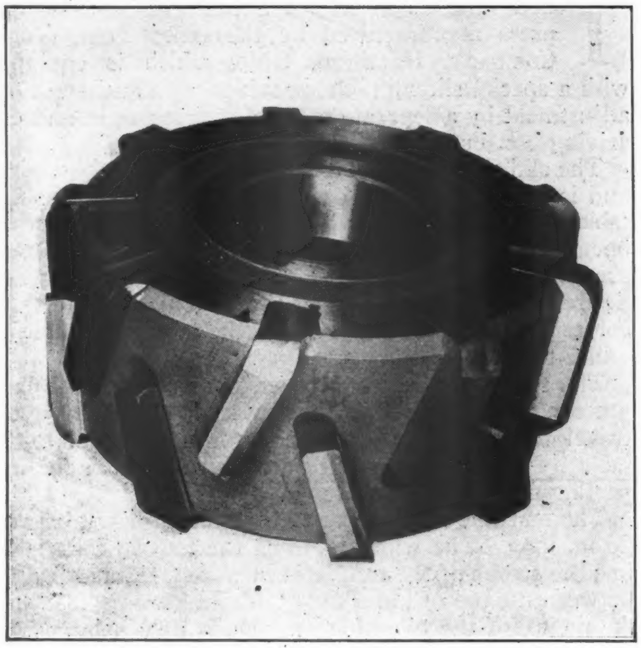
The shaft is made of nickel steel in one piece, and mounted on four heavy-duty ball bearings in dust-proof housings.

COFFIN FEEDWATER HEATER SYSTEM.—The J. S. Coffin, Jr., Company, 36 Grand avenue, Englewood, N. J., has issued a 12-page booklet descriptive of the operation of the Coffin feedwater heater system. The booklet is intended to instruct enginemen and enginehouse men how to operate successfully and inspect Coffin equipment. A diagrammatic drawing shows the flow of water through the system.

ARC-WELDED CRANE.—Catalogue No. C-100, entitled "Cleveland arc-welded roller-bearing crane," issued by the Cleveland Crane & Engineering Company, Wickliffe, Ohio, describes the construction features of overhead traveling cranes in which arc-welding is used in place of riveting and casting, and in which roller bearings are used throughout. The catalogue is well illustrated with detailed photographs and drawings.

Rod milling cutters

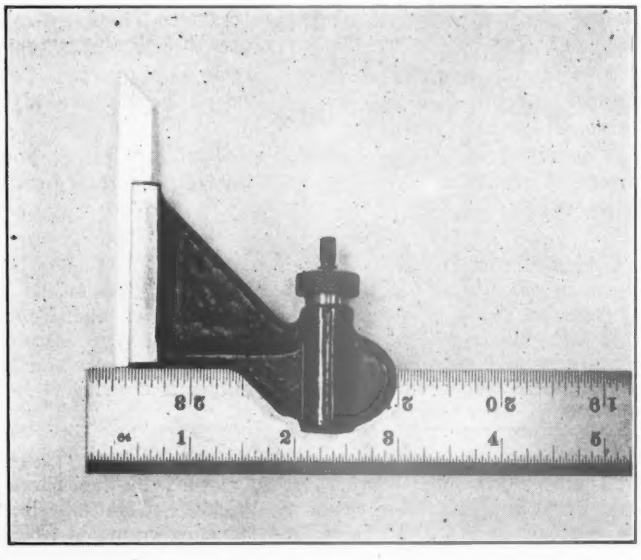
THE Goddard & Goddard Company, Detroit, Mich., has recently placed on the market a range of rod channeling and shank end milling cutters. They are of the inserted tooth type, intended for heavy duty. The high-speed steel teeth are of heavy stock and are tapered radially and also longitudinally, thus giving a double wedging angle resulting in maximum contact with the body and maximum support, and also rigidly locking the blade in place. The insertion of suitable shims, either in front of the blade or underneath it, sets the blade out as wear reduces its effectiveness. The shank end mills have a taper shank integral with the body and are furnished from 5 in. diameter by 3 in. length of cut to 8 in. diameter by 6 in. length of cut, with a suitable range of sizes between. Four different sized blades are applicable to the entire range, any one of which may be used in any individual cutter, if, in emergency, one does not have the proper blade at hand. The same is true of the channeling cutters which range from 8½ in. diameter by 3 in. width to 12 in. diameter by 7 inches width. Here again four different size blades are all that are necessary to make replacements on the whole range.



Goddard & Goddard inserted-tooth cutters designed for milling locomotive rods

Brown & Sharpe height-gage attachment

THE Brown & Sharpe Manufacturing Company, Providence, R. I., announces a new height-gage attachment, No. 465, for use with combination squares and sets. This attachment is used on the blade of the combination square and makes the tool a height gage. The vertical height of the scriber point is read directly. A feature of the attachment is that it can be used at all positions from the extreme top to the bottom of the blade. It is also reversible and can be used on either side of the blade. This gives the greatest possible range of measurements.



Height-gage attachment for use with combination squares and sets

The frame of this attachment is drop forged and has a smooth japanned finish. The pointer is made of high quality steel, hardened, tempered and ground. The inside end of the pointer projects from the body of the attachment to the edge of the blade so that the height at which the pointer is set can be read easily.

This attachment is useful in making comparative measurements, finding heights or projections from plane surfaces, etc. It is made in two sizes, one of which, No. 465A, is for use on Brown & Sharpe combination squares or sets having 9-in. blades and the other, No. 465 B, is for use on Brown & Sharpe combination squares or sets having 12-in., 18-in., or 24-in. blades. These attachments cannot be used on B. & S. combination squares or sets having heavy blades.

SMOOTH-ON.—The wide variety of conditions under which Smooth-On can be applied are illustrated in a booklet entitled "Helpful ideas for engineers," issued by the Smooth-On Mfg. Company, Jersey City, N. J. The applications suggested in this booklet are brief abstracts from the 136-page Smooth-On handbook.

SAWS, SAW TOOLS AND MACHINE KNIVES.—Catalogue No. 20 of E. C. Atkins & Company, 402 South Illinois street, Indianapolis, Ind., is cross-indexed in detail so that information on the various types of Atkins saws, saw tools and machine knives can easily be obtained. Owing to the varied uses for saws and the different classes of business affected, the complete product of the Atkins Company is divided into departments as follows: Mill saws, metal saws, the hardware line, saw tools and specialties, trowels, machine knives, manual training, repair work and special work.

News of the Month

THE BUREAU OF SERVICE of the Interstate Commerce Commission has issued a mimeographed circular of proposed amendments of transportation of explosives and other dangerous articles. Petitions pertaining to these amendments will be considered at the next oral hearing in Docket 3666. A memorandum of these changes include the following: Changes in the method of packing dynamite; increase in the maximum weight of charcoal screenings in cars over 36 ft. 6 in. long, increase in quantity and higher loading densities for anhydrous ammonia and liquefied petroleum gases; weight of express shipments of pyroxylin plastics increased; extension for one year from November 1, 1928, of the test period for special fiber board or pulp-board cases for matches, which includes a change in the shipping container specification, and the shipment of films by express, reel lengths extended.

Meetings and Conventions

Machine Shop Practice Division, A. S. M. E. national meeting

THE TECHNICAL SESSIONS of the national meeting of the Machine Shop Practice Division, American Society of Mechanical Engineers, will begin on Monday, September 24, at 8 p.m. aboard the steamer "Cincinnati," leaving for Ashland, Ky., where, on Tuesday morning, September 25, the continuous sheet rolling mill plant of the American Rolling Mill Company will be inspected. On Tuesday evening at 8 p. m. there will be a symposium on lubrication, the principal speaker being Forrest E. Cardullo, chief engineer, G. A. Gray Company, Cincinnati, Ohio, who will present a paper on the theories of bearing lubrication. The technical sessions will then be resumed at the Hotel Sinton, Cincinnati, Wednesday, September 26, at 9:30 a.m. The symposium on machine tools, their use and application in modern manufacturing methods, will include the automotive and railroad fields and other industries. L. N. North, shop superintendent, Illinois Central, Chicago, will discuss the railroad industry.

Inspection trips Wednesday afternoon and Thursday, September 27, will conclude the program for this joint meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers and the Machine Tool Congress.

Western metal Congress

PLANS ARE BEING DEVELOPED for the participation of twelve national technical societies in the Western Metal Congress, Western States Metal and Machinery Exposition, and the semi-annual meeting of the American Society for Steel Treating, which are scheduled to be held at Los Angeles, Cal., January 14 to 18, 1929. Five days will be devoted to technical sessions on the making, working and treating of metals, and the exposition will include displays of machinery, materials and appliances which will portray a complete cycle of the metal industry from the raw material to the finished product.

The societies co-operating in the preparation of the program for the technical sessions are the American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, California Division of Development and Production Engineering of the American Petroleum Institute, American Welding Society, Society of Automotive Engineers, Pacific Coast Electrical Association, Pacific Coast Gas Association, Institute of Marine Engineers, Metal Trades and Manufacturers Association, Chamber of Mines and Oils, National Purchasing Agents Association, and the American Society for Steel Treating.

Tool Foremen's convention

THE FOLLOWING program has been developed for the sixteenth annual convention of the American Railway Tool Foremen's Association to be held at the Hotel Sherman, Chicago, September 12 to 14, inclusive:

Wednesday, September 12

Meeting called to order at 9:30 a.m.
Invocation by Rev. Orvis F. Jordan
Opening address "Car shop tools", by P. Kass, superintendent of the car department, Chicago, Rock Island & Pacific, Chicago
Address by president, E. A. Greame, tool foreman, Delaware, Lackawanna & Western.
Report of secretary-treasurer, G. G. Macina, Chicago, Milwaukee, St Paul & Pacific, Chicago.
Appointment of committees
Unfinished and new business
Adjournment

Meeting called to order at 2:00 p.m.
Report of Committee on Proper Heat Treatment of Steel, Chairman H. L. Taylor, supervisor of shop machinery and tools, Baltimore & Ohio, Baltimore, Md.
Adjournment

Thursday, September 13

Meeting called to order at 9:30 a.m.
Address by D. C. Curtis, chief purchasing officer, Chicago, Milwaukee, St. Paul & Pacific, Chicago.
Response by E. J. McKernan, supervisor of tools, Atchison, Topeka & Santa Fe, Topeka, Kans.
Report of Committee on Standardization of Boiler Tools, by A. A. Ferguson, supervisor of tools, Missouri Pacific, St. Louis, Mo.
Report of Committee on Jigs and Devices for the Locomotive Shops, Chairman W. R. Millican, tool foreman, Missouri-Kansas-Texas, Parsons, Kans.
Election of officers
Adjournment
Special visit to exhibits

Friday, September 14

Meeting called to order at 9:30 a.m.
Report of Committee on Rake and Clearance of Machine Tools, Chairman, J. E. Carroll, supervisor of tools, Chesapeake & Ohio, Huntington, W. Va.
Report of Standardization Committee
Report of special committees
Selection of place for next convention
Convention adjournment

General foremen's program of exceptional interest

THE ACTIVITIES of the various committees of the International Railway General Foremen's Association during the past year have culminated in the form of an exceptionally well-balanced and interesting program for the 1928 convention which is to be held at Hotel Sherman, Chicago, September 18 to 21. The sessions have been arranged so as to be individual in their scope, each being devoted to an address, a topic and the discussion along specific lines.

The officers and Executive Committee of this organization are making a special effort this year to bring to the attention of mechanical officers the advisability of attendance at the 1928 convention on the part of shop superintendents, master mechanics, general foremen, car foremen, and shop and enginehouse foremen and have provided a program that will be of interest to all of these men.

Speakers that are well known throughout the country have consented to address the convention and, even though the presence of mechanical men at the meeting may call for some sacrifice or inconvenience, the effort apparently will be amply rewarded by the fund of information that the program affords. The General Foremen's Association has done an excellent piece of work in preparing for this event and it deserves the wholehearted support of every officer and supervisor who can find it possible to attend.

The complete program follows:

Tuesday, September 18, 1928
9:30 A. M.

Address of welcome by City of Chicago Representative
Response by J. H. Armstrong, general foreman, Atchison, Topeka & Santa Fe

Address by President F. M. A'Hearn, general foreman, Bessemer & Lake Erie
Report of secretary-treasurer, William Hall, Winona, Minn.
Appointment of committees and routine business

2:00 P. M.

Address by A. G. Pack, chief inspector, Bureau of Locomotive Inspection, I. C. C., Washington, D. C.
Response, C. F. Baumann, general car foreman, C. & N. W.
Topic No. 1—Reduction of federal defects, C. E. Horsley, general foreman, Illinois Central, chairman
Discussion

Wednesday, September 19
9:00 A. M.

Address by U. K. Hall, general supervisor of stores, Union Pacific System
Response, R. F. Farrington, general foreman, P. & L. E.
Topic No. 2—General foremen's responsibility for inactive stocks, George T. Boone, general foreman, Canadian National, chairman
Discussion

2:00 P. M.

Address by Roy V. Wright, editor, *Railway Mechanical Engineer*
Response, J. W. Gibbons, general foreman, Atchison, Topeka & Santa Fe Ry.
Topic No. 3—How to improve personnel relations, C. Y. Thomas, enginehouse foreman, Texarkana & Ft. Smith, chairman
Discussion
Election of officers.

Thursday, September 20
9:00 A. M.

Address by W. G. Black, mechanical assistant to president, Erie
Response, George H. Logan, general foreman, C. &. N. W.
Topic No. 4—General foremen's contribution to long runs, Frank B. Harman, assistant superintendent shops, Atchison, Topeka & Santa Fe, chairman
Discussion

2:00 P. M.

Topic No. 5—How to get more miles per car per day, W. J. McCloskey, general car foreman, Illinois Central, chairman
Discussion

Friday, September 21
9:00 A. M.

Address by W. E. Dunham, superintendent car department, Chicago & Northwestern
Response, J. Gullage, general car foreman, Boston & Maine
Topic No. 6—Passenger and freight car repair classification, A. H. Keys, Baltimore & Ohio, chairman
Discussion
Report of committees
Unfinished business
New business
Adjournment

Car officers associations are consolidated

THE EXECUTIVE COMMITTEES of the Railway Car Department Officers Association and the Southwest Master Car Builders' and Supervisors' Association, respectively, held a joint session, August 8, at the Hotel Statler, St. Louis, at which plans were perfected for a joint convention on September 11, 12 and 13. The question of consolidating the two associations into a single body was also discussed at length and it was decided that in the interest of economy and greater efficiency this step should be taken. The consolidation was effected, subject to the formal ratification of members at the joint convention, and the name "Master Car Builders' and Supervisors' Association" was chosen for the new association. The program of the joint meeting, to be held at the Hotel Statler, St. Louis, September 11, 12 and 13, is as follows:

Tuesday, September 11

10:00 a.m. Meeting called to order by G. W. Moore, assistant superintendent of motive power, St. Louis-San Francisco, and president, Southwest Master Car Builders' and Supervisors' Association.
10:05 a.m. Invocation by B. F. Jamison, special traveling auditor, Southern.
10:10 a.m. Address of welcome by Honorable Victor J. Miller, mayor of St. Louis.
10:25 a.m. Response by T. J. O'Donnell, chief interchange inspector, Niagara Frontier Interchange Association.
10:30 a.m. Address by President Moore.
10:45 a.m. Report of secretary-treasurer, E. H. Weigman, M. C. B., Kansas City Southern, for Southwest Master Car Builders' and Supervisors' Association.
11:30 a.m. Address by Henry Miller, president, Terminal Railroad Association of St. Louis.
12:00 a.m. Address by Colonel B. W. Dunn, chief inspector, Bureau of Explosives, New York.
2:00 p.m. Address by E. R. Campbell, St. Paul, Minn., president, Railway Car Department Officers' Association.
2:15 p.m. Report of secretary-treasurer, A. S. Sternberg, M. C. B., Belt Railway of Chicago, for Railway Car Department Officers' Association.
2:20 p.m. Address by R. C. White, assistant general manager, Missouri Pacific.
2:40 p.m. Address by F. W. Brazier, assistant general superintendent rolling stock, New York Central.
3:00 p.m. Paper and discussion on "Higher maintenance of freight car equipment to reduce terminal and transit delays," by L. R. Wink, assistant superintendent car department, Chicago & North Western.
4:30 p.m. Address on "Freight claim prevention in relation to maintenance of freight car equipment," by Joe Marshall, special representative, American Railway Association, Chicago.

Wednesday, September 12

9:00 a.m. Paper and discussion on "The elimination of angle cocks from passenger car equipment," by J. P. Stewart, general supervisor of air brakes, Missouri Pacific.
10:15 a.m. Paper and discussion on "Efficiency of car shop operation," by B. J. Huff, efficiency supervisor, Chicago & Eastern Illinois.
11:30 a.m. Report of committee on "Elimination of grease spots and the preparation of cars for commodity loading," W. T. Westall, assistant M. C. B., New York Central, chairman.
2:00 p.m. Report of Committee on Painting All Classes of Car Equipment, E. S. Wilkins, master painter, Frisco Lines, chairman.
3:00 p.m. Paper on "Testing of car materials," by J. R. Jackson, engineer of tests, Missouri Pacific.
4:00 p.m. Report of Question Box Committee (A. R. A. Rules of Interchange), J. Matthes, Jr., traveling car inspector, Wabash, chairman.

Thursday, September 13

9:00 a.m. Joint report of A. R. A. committee and discussion of A. R. A. Rules of Interchange, H. A. Siegwart, supervisor car repair bills, Missouri Pacific, chairman.
10:30 a.m. Discussion of A. R. A. (Division V) committee report on "Freight and passenger car lubrication and reclamation of waste and oil," by J. H. Gimpel, assistant superintendent car department, Wabash.
12:00 noon. Paper on "The Inspector," by A. Armstrong, chief interchange inspector, All Lines, Atlanta, Ga.
2:00 p.m. Report of Executive Committees on reorganization and consolidation of the two associations, S. O. Taylor, chairman. Southwest Executive Committee; B. F. Jamison, chairman. Executive Committee of the Railway Car Department Officers' Association.
3:00 p.m. Report of Nominating Committee and election of officers for the ensuing year.
4:30 p.m. Closing remarks by presiding officers.
5:00 p.m. Special remarks by T. J. O'Donnell.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, 165 Broadway, New York. Next meeting, April 30-May 3, 1929, at Stevens Hotel, Chicago.

AMERICAN RAILWAY ASSOCIATION DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting Windsor Hotel, Montreal, September 11-13.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago. Annual convention Hotel Sherman, Chicago, September 12-14.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid Ave., Cleveland, Ohio. Annual convention October 8-12, Benjamin Franklin Hotel, Philadelphia, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York. Fall meeting, October 8-12, Bellevue-Stratford Hotel, Philadelphia, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. &. N. W. Station, Chicago, Ill. Annual meeting, October 23-26, Hotel Sherman, Chicago.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting September 10 at 8:15 p.m. The construction of the Welland ship canal will be discussed by W. W. Butter, assistant engineer in charge.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago. Next meeting September 17, 8 p. m. Car inspection will be discussed by C. J. Nelson, chief interchange inspector.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—A. J. Walsh, 5874 Plymouth Apt. 18, St. Louis, Mo. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo. Next meeting September 13 at 8 p. m. Canadian Pacific will show pictures, "A trip around the world." Annual ladies night. Entertainment by Lew Fullerton, humorist. Dancing and buffet luncheon.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—(See Railway Car Department Officers' Association.)

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November. Next meeting September 11, Hotel Gibson, Cincinnati, at 6 p.m. A representative of the Baltimore & Ohio will present a paper on the "Iron Horse". Moving pictures.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant, Railway Exchange, 80 E. Jackson Boulevard, Chicago. 1929 Annual Heeting Hotel Sherman, Chicago, May 7-10, inclusive.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn. Annual convention Hotel Sherman, Chicago, September 18-21, 1928.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Annual meeting May 21-24, 1929, Hotel Biltmore, Atlanta, Ga.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston.

New York Railroad Club.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

Pacific Railway Club.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately. Next meeting September 20, Hotel Oakland, Oakland, at 7.45 p.m. Paper on automatic train dispatching will be presented by A. C. Holden, resident manager, General Railway Signal Company. Motion pictures.

Railway Car Department Officers' Association.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago. Joint convention with Southwest Master Car Builders and Supervisors Association, September 11-13, Hotel Statler, St. Louis, Mo.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting third Thursday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa. Next meeting September 27 at 7 p.m. eastern standard time. Paper on safety problems in coal mining will be presented by H. B. Greenwald, supervising engineer, United States Bureau of Mines, Pittsburgh.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Southwest Master Car Builders and Supervisors Association.—E. H. Weigman, master car builder, the Kansas City Southern, Pittsburg, Kan. Joint meeting with Railway Car Department Officers Association, September 11 to 13, Hotel Statler, St. Louis, Mo.

Texas Car Foremen's Association.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings first Tuesday in each month. Terminal Hotel Bldg., Fort Worth, Tex.

Traveling Engineer's Association.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.—Annual meeting Hotel Sherman, Chicago, September 25 to 28 inclusive.

Western Railway Club.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August. Next meeting September 17, Hotel Sherman, Chicago, at 8 p.m. Paper on "Where are the railways heading?" will be presented by Samuel O. Dunn, editor, *Railway Age*.

Supply Trade Notes

J. L. Lavallee has been appointed assistant manager of the railway sales division of the Texas Company, with headquarters at New York.

H. T. Heath, formerly sales engineer of the Illinois Motive Equipment Company, has been appointed representative of the Timesaver Products Co., Chicago.

William Hunter, acting manager of the Niles-Bement-Pond Company, with headquarters at Philadelphia, Pa., has been appointed manager of the Philadelphia office.

Elliot E. Van Cleef, 53 West Jackson boulevard, Chicago, has been appointed district sales agent in the Chicago territory for the Roller-Smith Company of New York.

Paul Mackall has been appointed vice-president of the Bethlehem Steel Corporation in charge of general sales, succeeding E. S. Kinsley, who has retired to less active duties.

Harold S. Russell has been appointed representative of the Southern Wheel Company, with offices in the McCormick building, Chicago. Mr. Russell succeeds A. K. Hohmeyer, resigned.

Max Epstein, president of the General American Tank Car Corporation, Chicago, has been elected chairman of the board, and will be succeeded by Elias Mayer, general counsel and vice-president.

Joseph E. Brown, eastern sales manager of the Central Valve Manufacturing Company, Chicago, with headquarters at New York, has been elected vice-president, with headquarters in the Railway Exchange building, Chicago.

The Kearney & Trecker Corporation, Milwaukee, Wis., is building a new three-story office building to adjoin its present office structure and provide increased facilities for offices that were formerly occupying shop area.

C. J. Olmstead, western manager, Westinghouse Air Brake Company, with headquarters at Chicago, has been appointed assistant to the vice-president. He will be succeeded by C. D. Foltz, who has been assistant western manager. A. K. Hohmeyer has been appointed assistant western manager.

Plans for the consolidation of Steel & Tubes Incorporated, Cleveland, Ohio, with the Republic Iron & Steel Company, have been negotiated and now await approval of the stockholders. Myron A. Wick, president of Steel & Tubes Incorporated, will continue to manage the business of that company.

J. B. Laughlin, a director, and member of the executive committee of the Jones & Laughlin Steel Corporation, died on August 12, at his summer home at Hyannisport, Mass. Mr. Laughlin had served as treasurer of the Jones & Laughlin Steel Company from 1904 to 1910. He was in his sixty-fourth year at the time of his death.

James McNaughton, vice-president of the Baldwin Locomotive Works, in charge of the New York office, who died on July 27 at his home in Bronxville, N. Y., was born on August 6, 1859, in Queensville, Ont. At the age of 14 he went to Woodbridge, Ont., to become apprenticed to a manufacturer there. Five years later he moved to the United States, and in 1881 entered the employ of the Northern Pacific as shop foreman at Brainerd, Minn. In 1889, he became division superintendent of rolling stock, with headquarters at Livingston, Mont. The following year he went to Waukesha, Wis. to become superintendent of motive power of the Wisconsin Central (now a part of the Minneapolis, St. Paul & Sault Ste. Marie). He remained with this road until 1899 when he became superintendent of the Brooks Locomotive Works at Dunkirk, N. Y. In 1902, upon the formation of the American Locomotive Company, he became general manager of the Brooks and Schenectady plants; in 1904 was appointed general manager at Schenectady, and in 1910, appointed vice-president in charge of manufacture. He resigned to become president of the Eddystone Munitions Company at Eddystone, Pa., in 1915, and in 1920, became vice-president of the Baldwin Locomotive Works.

James McNaughton

Alban Frederick Morris, vice-president and sales manager of the Morgan Engineering Company, Alliance, Ohio, has been elected president. Mr. Morris was born at Alliance, Ohio. After graduating from high school, he entered the employ of the Morgan Engineering Company as an office boy. He later worked in various offices of the company and as paymaster, after which he was employed in the estimating and cost department and then in the sales department. In 1903 he was appointed sales manager and, in 1923, vice-president and sales manager.

The National Aluminate Corporation, Chicago, has taken over the business of the Aluminate Sales Corporation, Chicago, and the Chicago Chemical Company. The officers of the new company are: Chairman of the board, Arthur Meeker, formerly president Aluminate Sales Corporation; president, H. A. Kern, formerly secretary-treasurer, Chicago Chemical Company; vice-president, P. W. Evans, formerly secretary-treasurer, Aluminate Sales Corporation and secretary-treasurer, H. A. Young, formerly office manager, Chicago Chemical Company.

Personal Mention

General

J. W. BURNETT, master mechanic of the Wyoming division of the Union Pacific at Cheyenne, Wyo., has been appointed assistant superintendent of motive power, with headquarters at Omaha, Neb.

C. H. TEMPLE, chief of motive power and rolling stock of the Canadian Pacific, with headquarters at Montreal, Que., has retired from the service of that road after having served for over 40 years.

H. B. BOWEN, assistant superintendent of motive power and car department of the Canadian Pacific at Winnipeg, Man., has been appointed chief of motive power and rolling stock, succeeding C. H. Temple.

THOMAS HAMBLY, assistant superintendent in the motive power and car department of the Canadian Pacific at Winnipeg, Man., has been promoted to general superintendent of the Algoma district, with headquarters at North Bay, Ont., succeeding Andrew Halkett, who has been transferred to the Alberta district.

CHARLES S. GILES, superintendent of machinery of the Louisville & Nashville at Louisville, Ky., has retired. Mr. Giles was born on November 2, 1856 at Rowlesburg, W. Va. He entered railway service in 1873 as a machinist apprentice on the Baltimore & Ohio at Wheeling, W. Va., and from 1877 to 1882, he was a machinist for this road, the Texas & Pacific, the Pennsylvania, and the Louisville & Nashville. From 1882 until 1887, he was roundhouse foreman and machine shop foreman, of the Louisville & Nashville. In 1887, he was appointed master mechanic at Birmingham, Ala.; in October, 1902, transferred to the main shops at Louisville, Ky.; on February 1, 1904, promoted to the position of assistant superintendent of machinery, and on June 30, 1911, appointed superintendent of machinery.

J. W. HIGHLEYMAN, assistant superintendent of motive power and machinery of the Union Pacific, at Omaha, Neb., has been appointed superintendent of motive power and machinery of the Oregon Short Line, with headquarters at Pocatello, Idaho, succeeding A. C. Hinckley, retired. Mr. Highleyman was born on December 24, 1868, at Spencer, W. Va. He entered railway service in July, 1886 as a machinist apprentice on the Missouri Pacific, and from 1893 to 1898 served as a machinist on the Union Pacific at Kansas City, Mo. During the latter year he was promoted to general foreman at Junction City, Kan.; in 1899, transferred to Kansas City; in 1906 appointed district foreman with headquarters at Laramie, Wyo., and, in May, 1912, promoted to the position of master mechanic at Cheyenne, Wyo. From March, 1918, to April, 1919, Mr. Highleyman served in France, during the latter year returning to Cheyenne as master mechanic. In August, 1923, he was promoted to the position of assistant superintendent of motive power and machinery with headquarters at Omaha.

C. J. BODEMER, acting superintendent of machinery of the Louisville & Nashville at Louisville, Ky., has been appointed superintendent of machinery, with headquarters at the same point. Mr. Bodemer has been in the service of the mechanical department of that railroad for 28 years. He was born on March 8, 1880, at Cincinnati, Ohio, and, after completing a course in the Cincinnati Technical School, graduated from a course in mechanical engineering at Purdue University in June, 1900. In August, 1900, he entered the service of the L. & N. as an apprentice, later being advanced to erecting shop foreman at Covington, Ky., where he remained until February, 1905, when he was transferred to the South Louisville (Ky.) shops. He then became assistant general foreman at the South Louisville shops and, until 1919, served successively in that position, as general foreman of the Etowah (Tenn.) shops, as general foreman of locomotive repairs and assistant master mechanic at South Louisville, and as master mechanic at the Decatur (Ala.) shops. On March 1, 1919, he was promoted to the position of assistant superintendent of machinery, with headquarters at Louisville. Mr. Bodemer's appointment as acting superintendent of machinery became effective on August 15, 1927.

A. C. HINCKLEY, superintendent of motive power and machinery of the Oregon Short Line at Pocatello, Idaho retired from active railroad service on August 1. Mr. Hinckley was born in 1863 at New York. He received his education at Meads College and entered railway service in 1885 as a machinist apprentice on the Chicago, Pekin & Southwestern (now part of the Atchison, Topeka & Santa Fe). Later he was advanced to machinist and, in 1891, became a locomotive engineman on the Chicago, Burlington & Quincy. From 1895 to 1900, he served as master mechanic of the St. Joseph & Grand Island at St. Joseph, Mo. He was then appointed road foreman of engines and, later, master mechanic of the Utah Central (now part of the Denver & Rio Grande Western), becoming master mechanic of the Denver & Rio Grande at Salida, Colo., in 1904, and master mechanic of the Cincinnati, Hamilton & Dayton (now part of the Baltimore & Ohio) at Lima, Ohio, in 1907. In January, 1910, he was promoted to the position of assistant master mechanic of the Southern Pacific at West Oakland, Cal. Later in the same year he was appointed master mechanic at that point and, in May, 1914, appointed superintendent of motive power and machinery of the Oregon Short Line.

Master Mechanics and Road Foremen

H. L. NANCARROW, assistant master mechanic of the Akron division of the Pennsylvania at Akron, Ohio, has been promoted to master mechanic of the Erie and Ashtabula division, with headquarters at Mahoningtown, Pa., succeeding H. S. Noble.

J. P. DRISCOLL, master mechanic of the Erie at Little Ferry, N. J., has been appointed master mechanic with headquarters at Secaucus, N. J. The position of master mechanic at Little Ferry, N. J. has been abolished.

JOHN GOGERTY, master mechanic of the Western division of the Union Pacific at Green River, Wyo., has been transferred to the Wyoming division, with headquarters at Cheyenne, Wyo.

Shop and Enginehouse

F. E. SIMMERMAN, assistant foreman of the Norfolk & Western at Eckman, W. Va., has been transferred to Bluestone, W. Va., succeeding E. L. Peters.

F. L. FRERICKS has been appointed assistant general foreman (Nottingham shops) of the New York Central, with headquarters at Cleveland, Ohio.

D. H. RICHMOND, has been promoted to the position of night enginehouse foreman of the Twenty-third street shops of the Chesapeake & Ohio at Ashland, Ky., succeeding R. L. Schroyer.

R. L. SCHROYER, night enginehouse foreman of the Twenty-third street shops of the Chesapeake & Ohio at Ashland, Ky., has been promoted to the position of day enginehouse foreman.

JOHN KEHOE, wheel foreman of the Delaware, Lackawanna & Western at Kingsland, N. J., has been promoted to the position of enginehouse foreman, with headquarters at Secaucus, N. J.

H. F. STALEY, mechanical inspector of the Norfolk & Western at Roanoke, Va., has been appointed general foreman, with headquarters at Kenova, W. Va., succeeding J. T. Heidler, deceased.

H. W. REYNOLDS, assistant general foreman of the Norfolk & Western at Bluefield, W. Va., has been appointed mechanical inspector of the shops at Roanoke, Va., succeeding H. F. Staley.